

ICHST
2017



25th INTERNATIONAL CONGRESS OF HISTORY OF SCIENCE AND TECHNOLOGY

Rio de Janeiro, Brazil, 23 - 29 July 2017

Book of Abstracts

ORGANIZATION



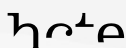
SBHC SOCIEDADE BRASILEIRA
DE HISTÓRIA DA CIÊNCIA

International Union of History and Philosophy of Science and Technology
IUHPST/DHST
Division of History of Science and Technology

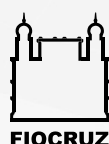
SPONSORS



UFRJ



programa de pós-graduação
em história das ciências e das técnicas
e epistemologia HCTE - UFRJ



Casa de
Oswaldo Cruz



MINISTÉRIO DA
CIÊNCIA, TECNOLOGIA,
INOVAÇÕES E COMUNICAÇÕES



Stand-alone papers

First draft of the professional career of the portuguese engineer Victor da Silva Freire Junior, from Lisbon to Sao Paulo: a documentary contribution

Adalberto da Silva Retto Júnior, Universidade Estadual Paulista Júlio de Mesquita Filho

For a better understanding of the urban São Paulo debate, in the early twentieth century, we must rely upon certain current ideas and practices which, on one hand, are related to the internationalization phenomenon of the typical urban debate of the 1880-1914 period, and, on the other hand, are related to the movement of Brazilian and foreign professionals (who came to Brazil) and their performances in the country.

A flood of other professionals with very distinct profiles and activities in this area was unleashed by following the professional path of Victor da Silva Freire Jr., through the schools he attended, International Urbanism Congresses, industry conferences, international exhibitions and the Congrès de la Route, highlighting different moments of the French foreign policy expansion in Brazil. Noteworthy in this research are the formative role of the École des Ponts et Chaussées to several engineers who worked in Brazil, in addition to references regarding urbanists in the international scene, and, especially, the first international urban planning conference held in England and Belgium, in which Freire participated.

International Urbanism; Victor Freire; Urbanism in Brazil

D'Alembert Between Newtonian Science and Cartesian Inheritance

Agamenon R. E. Oliveira, Polytechnic School of Rio de Janeiro

In 2017 the scientific community celebrates the tercentenary of D'Alembert birth. This paper is a tribute to him describing mainly his developments in mechanics in the context of newtonian science and cartesian inheritance. From cartesianism he kept the conception of intelligibility and of the knowledge rationality. On the other hand the newtonianism led him to study the laws of mechanics and the gravitational attraction with physico-mathematical approaches.

D'Alembert's work is not a trivial development of newtonian physics but it encompasses a true conceptual reorganization of mechanics, supported by the systematic use of differential and integral calculus with the formulation given by Leibniz. In addition to these influences we can also add leibnizian tradition, notably that introduced by John Bernoulli, which means, the current use of mathematical analysis and theoretical approaches.

D'Alembert has developed an original formulation of dynamics, transcribing Newton's three laws into three principles, given to them an intelligibility of cartesian type according to Michel Paty's studies.

History of mechanics; "History of mathematics; Leibnizian studies; Cartesianism

Development, Ecology, Disease and Medicine: A Study on Cinchona Cultivation in Bengal

Ajanta Biswas, Rabindra Bharati University

Uneven colonial developments resulted from the fulfilment of the requirements of the world free trade economy since the second decade of the 19th century upset the balance of ecology which led to the outbreak of many such diseases which had hitherto been unfamiliar to the people of subject nation. Malaria was among such diseases which had broken out in the late 19th century Bengal particularly in the district of central and south- west Bengal which told upon millions of people in the rural society and created havoc devastation in agricultural production and dislocation in the agrarian structure of those regions. The government health policy was not adequate to combat with the outbreak of the disease. Ayurvedic and homeopathy traditional treatments were only the ways of combating the disease but widespread phenomenon of the outbreak of the disease caused anxiety to the government, as it imposed ruinous effects upon both the industrial and the agricultural production system owing to the shortage of supply of labour. This anxiety led the government to think seriously to take the preventive measures. It was only the Quinine from the Cinchona bark could help the colonial government to conquer the disease. It became the tool of the Empire to protect the Imperial interest of the free trade economy. The objective of the paper is to focus on the process of Cinchona cultivation, meteorological survey, manufacturing of Quinine and distribution of it in the market to combat against the disease. The study seeks to explore how did the global free trade economy resulted from the industrial capitalism create lopsided developments in the colonial countries. All primary and secondary sources will be explored while preparing the main article. The official sources will include deposits in the archives. The non-official sources will consist of secondary works and contemporary literature, especially the newspapers, journals published from Calcutta, Darjeeling and from the small towns. Besides, the study also depends on the oral testimony of some employees employed either in cultivation of Cinchona or manufacturing of Quinine in the factory situated in Darjeeling district. Special emphasis has been drawn to the science and technological process applied both in the cultivation of Cinchona and manufacturing of Quinine. Outbreak of malaria has not ended. This paper would help to learn how to combat against the disease through the application of indigenous herbal resources.

Ecology; Disease; Medicine; Cinchona Cultivation; Bengal

Avicenna on spirit and materiality: A study of his al-Risalah al-adhawiyah fi amr al-ma'ad

Akihiro Tawara, Japan Society for the Promotion of Science

Avicenna's idea on the medical spirit (ruh) appears in his medical works, such as the Canon of Medicine and Cardiac Drugs. A work from another field also helps us understand his ideas on the spirit. A religious work, al-Risalah al-adhawiyah fi amr al-ma'd, in which he criticises theologians' opinions of bodily resurrection, includes accounts of the subtle body (jism latif). In the accounts, Avicenna criticises Thabit b. Qurra's thought: that the subtle body adheres to the human soul after the body's death and survives it. In this paper, I will investigate Avicenna's position that led him to refute Thabit b. Qurra's argument on the subtle body. This paper aims to clarify Avicenna's ideas on the spirit by investigating religious works along with medical works, and confirm the importance of analysing his concept of spirit from several viewpoints.

Arabic medicine; Avicenna; Arabic philosophy; Islamic philosophy; Ibn Sina

Accommodation and prediction in Special Relativity. On what evidence was the theory accepted?

Alejandro Cassini, Buenos Aires University

Einstein's theory of Special Relativity was accepted by most German physicists around 1911. In other countries its acceptance was delayed by many years. What was the evidence that confirmed Special Relativity at the beginning of the second decade of the Twentieth Century? Stephen Brush has recently suggested that the only relevant evidence was the explanation of the null result of the Michelson-Morley experiment. I contend that this claim is wrong and has to be corrected. It is true that no novel prediction derived from Special Relativity was confirmed back then, and it is also true that some of those predictions have still not confirmed. However, Einstein's theory was able to accommodate a wealth of experimental outcomes on the optics of moving bodies, and not just null results. Among them, it was of special significance the purely kinematical explanation of Fizeau's 1851 experiment on the speed of light in running water, which had a genuinely positive result.

References - Brush, S. (2015) Making 20th Century Science: How Theories Became Knowledge. New York: Oxford University Press.

Special Relativity; theory acceptance; evidence; accommodation; Fizeau's experiment

Of the difficulty of Special Needs Education - in its historiographic production - to reclaim the place of IDIOCY within Intellectual Deficiency net of conceptual filiations

Alessandra Santana Soares e Barros, Universidade Federal da Bahia

Nowadays, it is the knowledge and practices of the teachers that are directed to the mentally disabled child - the one with Down or autism. However, for the "idiot" child of the 19th century - the one equally with Down or autism (or even with deafness and blindness or cerebral palsy) - it was the knowledge of a "newborn" psychiatry that took place instead. This shift in the establishment of authority over this sub-class of "alienated people" took place as important disputes of power between educators and health professionals.

However, regarding the relevance of this aspect in the dynamic of knowledge production of Special-needs Education, not enough theoretical analysis has been produced in Brazil regarding, for instance, the place of asylums in the process of institutionalization (both conceptual and assistance-related) of Mental Disability. Hence, in the form of a bibliographic documental research, we analyzed the impact of literary pieces from the main Portuguese-writing authors that fed, either directly or indirectly, the historical analysis of Special-needs Education in Brazil, over the last three decades. It was done so to highlight the epistemological distance that these authors kept the "idiot" from the past, despite its evident conceptual similarity, to the mental/intellectual disability of the present.

From a methodological perspective, the research was done through the meta-analysis of the scientific articles that covered the history of special-needs education and that replicated as theoretical references the above mentioned classic authors. This empirical corpus was traced taking in consideration the sum of articles published in the last ten years on an important periodical of this field - The Brazilian Special-needs Education Magazine (in Portuguese: Revista Brasileira de Educação Especial).

One of the main finds is related to the fact that a large portion of the researchers either ignored or underestimated the precursor aspect of the "School-Pavilion for Abnormal Children" from the National Asylum of the Alienated (Hospício de Pedro Segundo/Hospital Nacional de Alienados), in regards to the educational assistance applied to the disabled youth. It was equally evident the

excessive linearity of the historical narratives made in the name of Special-needs Education in Brazil, since those give rise to a teleological perspective of the progress with the ways to conceive deficiency and to intervene socially upon it.

idiocy, special needs education, disability studies, history of mental retardation

Concatenation, Coalescence, and Cladism: Conceptual Disputes in Phylogenetic Inference

Aleta Quinn, California Institute of Technology

In this paper I analyze a recent debate between advocates of two distinct methods of phylogenetic inference (inference about the branching pattern of the history of life, to be reflected in taxonomic classification). The debate has occupied successive issues of *Molecular Phylogenetics and Evolution* and *Cladistics*, building on highly visible review papers in *Trends in Ecology and Evolution* (J. H. Degnan & Rosenberg, 2009) and *Annals of the New York Academy of Sciences* (Liu, Xi, Wu, Davis, & Edwards, 2015). I argue that this debate descends both historically and philosophically from an earlier debate between proponents of the use of parsimony versus proponents of the use of maximum likelihood. What is ultimately at issue is a disagreement about what concepts, methods, and assumptions are fundamental components of phylogenetic theory versus “merely empirical” assumptions that are unavoidable simplifications made by individual methods. Each side claims to be supported by a basic appeal to “first principles”. Drawing on features of the multi-species coalescent model, and by reflection on a proposed conceptual resolution to the prior debate, I demonstrate a critical asymmetry in the arguments. Proponents of coalescence can make a stronger claim to the conceptual foundations of phylogenetics, once the relationship of coalescence to concatenation methods is better understood. In addition to arguing for this thesis, I clarify eight distinct senses of the term “cladist” which have sometimes been conflated in the philosophical and historical literature. The most common meaning of “cladist” in the philosophical literature is not the most common meaning of “cladist” in the scientific community.

phylogenetic inference, parsimony, maximum likelihood, concatenation, coalescence

The Genesis of the "Principle of Insufficient Reason" in Leibnizian Thought and its Implications in the Principle of Maximum Entropy

Alexandre Lyra de Oliveira, UFRJ

Marcelo Mattos Antunes, UFRJ

Carlos Benevenuto Guisard Koehler, UFRJ

In this work we seek to investigate in Leibniz's work the foundations of his philosophy that are pertinent to the principle of maximum entropy of Jaynes.

Starting from C. Shannon's concept of entropy exposed in his work "Mathematical Theory of Communication" (C. Shannon, Bell System Tech., 379.623 (1948)) We note that this concept it has the same functional form as the Boltzmann-Gibbs statistical entropy. This is not surprising, since Shannon claimed he was inspired from the analysis of Boltzmann-Gibbs theory. Then, we analyze how E. T. Jaynes (Phys. Rev. 106, 620 (1957)) proposed his Principle of Maximum Entropy emphasizing the historical roots of the so-called Principle of Insufficient Reason, which he attributed to Laplace. He even considered the principle of maximum entropy as an extension of the principle of insufficient reason. Our study indicates that this principle has its roots in the Leibnizian philosophy, when Laplace

states in the introduction to his book "Essai Philosophique sur les Probabilités" (pp. 6, 7, (1814)) that Leibniz's Principle of Sufficient Reason also Applies to events whose causes can not be known to us, due to the limits of our knowledge. Leibniz states that "Nothing happens, without there being a sufficient reason to be so, and not otherwise, although many times these reasons can not be known to us." (La Monadologie, p. 607, Philosophischen Schriften, vol. VI, Gerhardt, (1885)).

We consider Laplace's reference to Leibniz in his "Essai Philosophique sur les Probabilités", a convincing proof that allows us to affirm that the principle of insufficient reason predates Laplace and can be found, for example, in Leibniz's philosophy, in his manuscripts on probabilities (Estime des Apparences, M. Parmentier, 1995). In his book "Nouveaux Essais sur L'Entendement Humain" (Philosophischen Schriften, p.39, vol. V, Gerhardt (1882)) and also in several correspondence of Leibniz with Jacques Bernoulli (Leibnizens Mathematische Schriften, 1850-1863) .

Finally, we recall that in a letter that Leibniz sent to Queen Sophia Charlotte in 1702, he said: "In some cases the natural light of reason is insufficient to inform us the details of things and our experiences are very limited so that we can glimpse your laws. " (G.W. Leibniz, "Philosophical Essays", Garbier (1989)).

Principle of Insufficient Reason, Principle of Maximum Entropy, entropy, Leibniz

Public activism as an engagement practice in Brazil

Aline Bastos, Federal University of Minas Gerais

Policies for public engagement in S & T indicate a path to openness and citizen participation, as it aims to bring citizens more actively in the process of making decisions on science issues (LEWINSTEIN, 2010). The Public Engagement Project Report for Innovations to Horizon 2020 analyzed cases of public engagement and established five possible categories: public communication, public activism, public consultation, public debate, public participation (RASK et al, 2016). They also identified a strong involvement and growth of the fourth sector, involving a network of hybrid public and volunteers, similar to the formation of public advocated by Dewey (1954). In this way, public activism stands out as a practice to inform and create awareness in order to influence decision-making processes. The information flow is one way, but in the sense of citizens to decision makers. These are emotionally connected actions with individuals emotions and ethical and moral values which cause a sense of urgency.

A recent case of public activism in Brasil occurs with the called "cancer pill". Over the past two years, an intense public debate mobilized Brazilian society about the uses and effectiveness of synthetic phosphoethanolamine, popularly known as "phospho or" cancer pill ", focused on the treatment of cancerous tumors. The controversy began in University of São Paulo, which were developed researches with the substance and involved various sectors of Brazilian society, such as National Congress, Justice, Public Ministry, Press, Scientific community and Regulatory Agencies.

The most critical point of all this scientific controversy was the enactment of Law No. 13,269, of April 13, 2016, which authorized the use of synthetic phosphoethanolamine for patients diagnosed with cancer, "independent health tests, (...)" (BRAZIL, 2016). The measure came to answer the public opinion appeal, since at that time there was a national polemic and a strong ethical and moral debate about the strict rules and scientific standards. The decision, however, soon suffered repudiation of the medical and scientific community, because it "hits" all scientific and security protocols. About a month later, in a preliminary decision, the Supreme Court suspended the law. However, this unprecedented decision deserves further investigation, as it meant an empowerment - even if momentary - of publics, which turned out to influence a scientific research in Brazil.

Public Engagement; Public Ativism; Scientific Controversy

Hearing, fearing, and exploiting the unfamiliar sounds of the 1940s

Alistair Sponsel, Vanderbilt University

In the years during and immediately after World War II, the French theorist and composer Pierre Schaeffer made a philosophical and artistic virtue of what he called “acousmatic” sound, i.e., sound whose cause is not known. Exploiting the fact that technologies for audio recording made it possible to separate the phenomenon of a sound from its original physical cause, he pioneered a compositional style known as “musique concrète.” Meanwhile, listeners in the United States were confronting a new scientific puzzle posed by sonar technology that had been developed for use in the detection of submarines. The ocean was full of unidentifiable sounds that masked a deadly threat. I examine the shared technological and epistemic resources of, on the one hand, sonar operators and the marine biologists to whom they turned for assistance in identifying the causes of the various sounds perceived via their hydrophones and, on the other hand, experimental musicians capturing, composing with, and philosophizing about environmental sound.

technology; sound; music; listening; submarine

The Science Diplomacy of atoms: Brazilian scientists and the Atoms for Peace initiative

Amanda Almeida Domingues, University of São Paulo

Janina Onuki, University of São Paulo

The Atoms for Peace program was the most acclaimed science diplomacy initiative of the United States during the Cold War. Science Diplomacy is a strategy used by political actors to stimulate scientific interactions between nations in order to achieve certain objectives such as, for example, to strengthen the bonds of partnership, to propose solutions to common problems, and to build knowledge. The Atoms for Peace Program was an essential piece of the United States’ defense strategy, as well as of its foreign policy.

The program worked through the sharing of scientific and technological information for peace applications of nuclear energy and set a range of ambitious goals such as creating political allies and controlling and avoiding the development of nuclear weapons outside the United States. Above all, it was a soft power strategy.

Latin America was one of the main targets of the program and, among all the countries, Brazil was at the top of the list: it was the most advanced Latin American country in terms of nuclear development. Historiography has already shown that Brazil had a small but internationally recognized and consolidated nuclear physics community and had invested economic and political resources in national nuclear programs. It also described events such as the Kubitschek years, when Brazil’s uranium export policy was renegotiated and more offers were made from the United States, as well as the first years of military dictatorship, when Brazil prepared plans for the full development of nuclear energy and adopted a policy of firm opposition to the Non-Proliferation Treaty.

Although current historiography adequately describes the impacts of the Atoms for Peace program on the bilateral relations of the United States and Brazil, it still does not fully address the scientists themselves, the key component of Atoms for Peace as a science diplomacy strategy. Science Diplomacy concerns the interaction between politicians and scientists and thus this essay fills the gap in the literature. It explains the involvement of the Brazilian research community in the negotiations around nuclear materials at the beginning of the Cold War in the context of the Atoms for Peace program. We examine the scientists’ professional profiles and investigate their relationship with politicians, their involvement in politics and the arguments they used during international conferences such as the United Nations Conference for the Peaceful Uses of Atomic Energy.

Isfahānī vs. Darwin: A Muslim Reception of the Theory of Evolution

Amir-Mohammad Gamini, University of Tehran

Erfan Khosravi, University of Tehran

Muhammad Riza Isfahani's *A Critique of Darwin's Philosophy* (1913) is one of the first Muslim responses to the both scientific and materialistic aspects of the theory of evolution.

Isfahani; was, originally, a Persian Shi'ite clergy, born in Isfahan (1870) and educated in traditional Islamic schools of holy cities of Iraq. Comparing to his contemporary anti-Darwinism, he puts forward a scientific critique based on the latest biological papers and books translated into Arabic at his time, such as a commentary of Büchner of Darwin's theory (which probably is *Progress in Nature and History in the Light of the Darwinian Theory* (1884)) and a summary of the first chapter of Darwin's *The Descent of Man, and Selection in Relation to Sex* (1871), while the other anti-Darwinists contented themselves with rumors and non-original sources.

Isfahani believes that the theory of evolution for the non-human beings is not in contradiction with Islamic discourse and holy texts. He mentions some holy verses admitting that the creator does not create His creatures in person, but He uses intermediate laws, such as the mechanism of natural selection. Nevertheless, contrary to Darwin's assertion in his *The Descent of Man* which says natural selection equally works on all creatures including humans, Isfahani denies evolution of human from other animals, due to his Islamic understanding. He justifies his opinion through a detailed refutation of Darwin's evidences for human evolution, such as similarities between anatomy, embryology and vestigial organs in human body and other animals.

Amongst the post-Darwinian evidences for descent of man, he denies the proving ability of Eugène Dubois's hominid fossil discoveries in Java and Ilya Mechnikov's statements of behavioral similarities between animals and humans. We would present his refutation in detail and examine it in comparison to the power of justification of the evolution theory in the 1910s.

After the introduction of theory of Darwinian evolution to the Islamic world, the Islamic scholars received it in various responses which one can categorize them in four groups:

1. Modernist Muslim scholars.
2. Conservative scholars
3. The next group acceptances of theory of evolution, as a scientific theory,.
4. The last group express similar ideas to the former one, in spite of the fact, they find explicit verses of Quran not against the evolutionary view of human origin, because they considered them symbolic.

Darwin; Islam and Science; Isfahani;

An assessment rubric for Biology teacher-students' writing of a historical vignette

Ana Claudia Couló, Universidad de Buenos Aires - Instituto Joaquín V. González

Alicia Di Sciuillo, Instituto Joaquín V. González / CBC - UBA

The curriculum for pre-service Biology teachers at Instituto J.V.González (Buenos Aires) entails students' taking a yearlong Workshop on History and Philosophy of Science. Through that academic year, students are expected to read, reflect and debate on several historiographic and philosophical questions related to natural science and especially to life sciences (Matthews 2015, Kampourakis 2013). Simultaneously, workshop activities and assessment imply that they work on successive drafts of a historical short story or vignette about a relevant episode in Biology or Medicine history

informed by a well-founded epistemological perspective (Navarro & Chion, in Blumner & Childers, 2016; Adúriz-Bravo & Izquierdo-Aymerich 2009). Evaluation of the workshop implies presenting both a written complete version of the vignette and a poster that displays the vignette and the historiographical and epistemological decisions that went into writing it. Students are free to choose historical episodes, though they are encouraged to select locally or regionally relevant ones. In this presentation we will present and discuss the theoretical framework that underlies the workshop plan, emphasizing on the design of a rubric that can help assessment both from teachers' standpoint and from students' perspective (self and co-assessment). Perceived demands from assessment tasks tend to modify ways of teaching and learning both from teacher and students (Tang 1991; Perrenoud 1988). Rubrics, by describing desirable qualities and usual problems with students' work, can be a helpful tool, provided they (and their users) are flexible enough to recognize and include possible unexpected approaches (Goodrich Andrade 2005). Co-creating rubrics between colleagues, and with students, can offer fruitful occasions for metacognitive discussion on aims, concepts, skills, and values involved in teaching, learning, and writing in science classes.

Science teaching; History and Philosophy of Science; Rubrics

Analysis of the transposition of traditions, machines and tools between Europe and Brazil in the construction of the hydraulic mills of the South of Brazil

Ana Fausta Borghetti, UNICNEC - Centro Universitário Cenecista de Osório
Walmir Thomazi Cardoso, PUC - São Paulo

The present work is the result of a doctoral thesis whose main theme was the study and comparison of the traditions, machines and tools used in the construction and operations of the hydraulic mills that are part of the "Caminho dos Moinhos", at Taquari (RS) Valley, in the passage of centuries XIX and XX, the period of Italian immigration to Brazil. The qualitative research took place with residents, owners, historians and relatives of mill builders and water wheels in the investigated area. The data collected in loco were compared to those found in sources such as manuals and other texts of that time, relating the characteristics of the French, American and Austro-Hungarian milling with those found and developed in the region investigated. In relation to the French milling, we did not find anything referring to its characteristics in the researched place. In the American or English milling, the millstone has 1,30 m in diameter, and this characteristic was found in all investigated mills. The Austro-Hungarian milling was responsible for the creation of the cylinder, the plansichter and the sassor. The sassor was not found in the researched mills; the cylinder was found at the Castaman Mill, imported from Switzerland. As for the plansichter, it was found in three of the six investigated mills. We also investigated the strainer, which was found in all mills investigated, following the pattern found in the literature. The hammer follows the pattern found in the literature, but with the use of videa, an adaptation made at Taquari Valley. As for the lifts and the box, they follow the European pattern. The Archimedes Screw appears in the mills performing two functions: mixer and/or conductor. In relation to the generation of energy, we found Ruston diesel engines imported from England; remnants of the use of water wheels; hydraulic turbines, locomove and electric power generators. It was observed that the tradition followed at Taquari Valley is not Italian, as it was thought in the beginning of this investigation, but European. This dialogue contributed as part of the construction of the material and immaterial patrimony of the region of Encantado, in Rio Grande do Sul, Brazil.

hydraulic mills; machines; tools; traditions; history of technology

Observations and proofs protocols of Piaget between 1919 and 1922

Andre Elias Morelli Ribeiro, Amapa Federal University

The Clinical Method used by Jean Piaget in his work was developed in his initial years at Geneva, when he was Work Director of Jean Jacques-Rousseau Institut. It is possible to see some of the aspects of Clinical Method in his works published back in the 1920's years. Some attempts to describe the genesis of the method were made based in a comparative method, analyzing differences of the method over the Piaget's works (VIDAL, 1994; DELVAL, 2002). After the decease of Laurent Piaget, Jean Piaget's younger son, the Piaget's family decides to donate the Piaget's intellectual heritage in 2011, starting a new stage in the research of the history of Genetic Epistemology. This paper analyze 199 protocols written by Piaget's hand between 1919 and 1922 in Geneva, as part of his experimental and observational work. The material used in this work was collected, organized and classified by researchers of Archives Jean Piaget (BURMAN; RADCLIFF, 2015). In despite of the excessive caution to interfere in the child work in the book *The Language and Thought of the Child* (PIAGET, originally published in 1926), the protocols are more compatible with the papers published by Piaget between the years 1920 to 1923, where it is possible to observe some of the famous Piaget's proofs, mostly based in Caryl Burt intelligence tests. In this papers (PIAGET 1920a; 1920b; 1921; 1922a; 1922b) Piaget makes dialogues with the child, where it is possible to vislumbate his early theory, specially in the questions made by Piaget to understand the answer of the child. In the protocols, some notations are different of the papers and the books, showing new elements of the history of the clinical method.

Clinical method; Piaget protocol; Genetic Epistemology

Shoo, shoo, birdie! The Brazilian reception to German scientific expeditions, 1933-1942

André Gomes Julião, PUC-São Paulo

Silvia Waisse, PUC-São Paulo/Cesima

The period from 1933 to 1942 was marked by visits of foreign scientists who came to perform expeditions in the interior of Brazil. Many such scientists were German, who made profit of the intensive cultural, trade and scientific exchange between the two countries to collect animal specimens and objects for museums in Germany, in addition to advertising the development of German science. This satisfactory state of affairs began to erode in 1938, when the nationalistic policy enacted by president Getulio Vargas was associated with persecution of immigrants. In 1942 Brazil broke off its diplomatic ties with Germany and entered World War II on the Allies' side, which put an end to scientific expeditions and two German scientists then in Brazil were jailed.

Analysis of documents relative to the Council for Supervision of Scientific and Artistic Expeditions to Brazil (CFE), created in 1933 to supervise travels of foreigners and exports of scientific materials, demonstrates a clear shift in how scientific visitors were treated before and after 1938. Otto Schulz-Kampfenkel and Hans Krieg were received with much enthusiasm by government agents and scientists in 1935 and 1937, respectively. This although both attempted to bring a large amount of scientific materials with them upon returning to Germany, a practice that was restricted or even banned by the Brazilian government. In turn, Helmuth Sick and Adolf Schneider, who arrived together in 1939, were not given the same warm reception and worse, they were jailed in 1942 even though they had fully complied with the legal requirements for their trip and specimen collection. Stories in contemporary journals and CFE documents show that while arising some mistrust among CFE members, Schulz-Kampfenkel and Krieg had sound relationships with locals through the highly influential German colony that had settled in Brazil starting at the end of the 19th century. This is

how they succeeded in performing their expeditions, regardless the fact that Schulz-Kampfhenkel did not have a scientific record and Krieg attempted to export animals illegally. Despite their scientific expertise and the support of reputed Brazilian scientists, Sick and Schneider could not defeat the shadows of war. The former remained in jail until the end of the war, and the latter was deported after spending a time in prison.

Scientific expeditions; Brazil; 20th century; Vargas' dictatorship, German naturalists, World War II

The local biography of cesarean section: Contributions of the social studies of science and technology to analyse the normalization process of the surgical technique of giving birth in Brazil

Andreza Rodrigues Nakano, IFF/Fiocruz

Claudia Bonan, IFF/Fiocruz

Luiz Antônio Teixeira, COC/Fiocruz

Cesarean section occupies a prominent place in public and medical debates, representing more than 50% of births in Brazil. This presentation discusses the thesis of the normalization of cesarean delivery as a way of being born today. With the social studies of science and technology perspective, this study analyzes the social biography of the cesarean section, starting from the understanding: 1) that it is an actant: it provokes, influences, participates actively in the configuration of associations between actors, groups and institutions; 2) of the co-construction of the surgical technique and of those who execute it, experience, demand, offer and regulate - that is, doctors, women, maternities, families, market and State. The use of cesarean today is different from that of the early twentieth century, when labor was not vaginally resolved and / or the mother's life was at risk. The biography of the cesarean section showed that the global pathways of improvement of the technique marked the local circuit of its development, with Jorge de Rezende, author of Obstetrics and Professor at Maternidade Escola / UFRJ. He asserted his position as "caesareanist" and issued his "preferred technique" to generations of obstetricians through his treatise. The analysis of the improvement of the surgical technique showed that the changes - especially in the direction of the abdominal and uterine incision and in the sutures of the surgical planes - not only served to achieve better clinical results, but added an esthetic value to the surgical procedure of being born. The local trajectory of the cesarean section is based on the peculiarities of gender normative standards (understanding of the female body and motherhood, among others), the configuration of the health system and its users (public and private), the values attributed and the forms of dissemination and use of medical technologies and surgical interventions. In Brazil, the cesarean section was registered as a delivery route for both specialists and laymen. The incorporation of technique as an always available and even substitute alternative to the physiological process ends up shaping the experiences and discourses about childbirth, producing effects both in the way individuals individually perceive their bodies - specifically, the pregnant and parturient body - and narratives, language and values around the birth and birth event.

Cesarean section; Birth; Local biography; Normalization; Brazil

“Technology’s storyteller” reloaded: text-mining “Technology & Culture” (1959-2016)

Anita Lucchesi, University of Luxembourg

Andreas Fickers, University of Luxembourg

In 1985, John Staudenmaier published “Technology’s Storyteller: Reweaving the Human Fabric” which became a landmark and reference for generations of historians of technology. As acting chief-editor of *Technology & Culture*, the journal of the Society for the History of Technology (SHOT), Staudenmaier certainly had a privileged access to the archives of the Society and to its main publication organ. In using some 300 articles published in *Technology & Culture* as a mirror of the questions, debates and approaches that had characterized the discipline of history of technology in the United States between the late fifties and mid-eighties, Staudenmaier aimed at looking for patterns of consensus in the authors’ choice of periodization, spaces and types of technology to study. While remaining quite limited both in scope of material studied (300 articles) and topics identified (e.g. the relation between science and technology, the relationship between invention and innovation, and the question of technological progress), this paper aims at applying text-mining software (e.g. MALLET and Paper Machines) to the complete collection of articles of *Technology & Culture* between 1959 and 2016 (some estimated 1.000 articles). By applying different tools for topic modeling and visualizations of semantic relationships, the paper will try to:

- 1) compare our quantitative findings of patterns of subjects with the ones produced by Staudenmaier (1959-1984);
 - 2) offer a “distant reading” of the total corpus aiming at identifying key topics, concepts and personalities in the field;
 - 3) critically reflect on the possibilities and limitations of text-mining and data-visualization software (“tool criticism”) and as such
 - 4) promote a “digital hermeneutic”-approach in the field of history of science & technology.
- Tinkering around MALLET, the paper will use the probabilistic model known as Latent Dirichlet Allocation (LDA) as an attempt to insert semantic meaning into vocabulary and provide discoveries through a large volume of texts. The topic modeling algorithms, as a form of text-mining, allow the identification of patterns in a corpus. To allow further experimentations, all the articles studied will be stored in a Zotero collection. From Zotero, it will be possible to run the multi-tools of Paper Machines and explore other types of visualizations (e.g. word clouds, phrase nets and map geo-references) and topic models based on LDA.

History of Science and Technology; Technology & Culture; digital hermeneutics; distant reading; topic modeling

From the Local Nature Museum to the Formation of Scientific Outlook. Moldengauer's Museum in Tzarskoye Selo. 1913-1918

Anna Samokish, Saint-Petersburg Branch of the Institute for the History of Science and Technology RAS

The beginning of XX century in Russia was marked by a new round of development in natural sciences. By the early XX century Russian science was at a high level and was actively involved in international scientific relations. The development of science was accompanied by the development of education and popularization. However, the conditions at the Russian public school with its limitations in the program area made this development impossible. It was shifted to departmental and private schools and extra-curricular activities.

The museum of local nature in Tzarskoye Selo could be an example of such institutions. It was created by an enthusiast of natural science education V. Moldengauer on the territory of the

Alexander Park in the suburbs of St. Petersburg in 1913. Unlike many local history museums already existed that institution was aimed not just to show the nature, but to teach students to understand and analyze it, provide the foundations of scientific knowledge. Moldengauer involved scientists and science educators to create the museum departments and work there. Also the museum held the scientific research in the parks nearby. Museum tutors instructed the nature tours, the rooms were the shelter for young people and tourists had an opportunity to be acquainted with the local nature. In the fall of 1917 the museum was deprived of material support for the elimination of Governance of the palace which it previously had been administered by. Moldengauer tried to save the museum and developed a plan for the conversion of a single institution to biological stations for students where they would be able not just relax after a tour carried out by specialists, but also to attend lectures and perform practical classes. He planned the creation of laboratories like at the university, participation of professional scientists and educators. In 1918 Moldengauer died before he could realize implement his idea. It was taken up by other popularizers of science and the Museum became the prototype for the system of biological stations developed in the 1920s in Petrograd which was important for the development of a scientific world outlook of schoolchildren and even helped to save the lives of several scientists during the hard times of Civil war. So the idea of "pocket" or "toy" museum really played an important role in the history of biological science in Russia.

Supported by the RFBR grant №15-03- 00017 (E. Kolchinsky)

local nature museum; natural science education; science popularization

Apartheid legacies and hope in South African Drug Discovery

Anne Pollock, Georgia Tech

This paper draws on research at a small South African pharmaceutical company with an elite international board of advisors, founded in 2009 with the mission of finding new drugs for TB, HIV, and malaria. The company's name, "iThemba," means "hope." Here, I focus on how apartheid legacies shaped iThemba's project, on both micro and macro levels.

One of the company's co-founders had been a senior figure in South African research and development science during the democratic transition, and had met the other iThemba co-founders while setting up exchange programs that sought to foster a scientific workforce inclusive of the black majority. Another co-founder, a prominent American drug discovery scientist, saw untapped potential in the strong South African research universities with limited drug discovery exposure, which he judged to be a legacy of apartheid-era sanctions. Both were inspired by the possibility of innovation by and for a new, multiracial, democratic nation. They were successful in securing start-up funds from the South African government, which owned half the company. Legacies of apartheid are also important in understanding how the young, racially diverse bench scientists have understood their work as contributing to their country and continent.

Whereas in the early 20th century there were aspirations that science could unite white South Africans across ethnic divides as they contributed to what Saul Dubow has characterized as the "commonwealth of science," in the early 21st century, South African science had become at once more marginal globally and more inclusive nationally and regionally. During the intervening period of apartheid, state-owned enterprises and R&D did innovative work, but for the benefit of the white minority. The transition from that model to one in which science would be in the service of (the majority of) the people has been a rocky one, and is incomplete.

If, as Paul Edwards and Gabrielle Hecht argue, nuclear and computer systems were key in the technopolitics of apartheid, the iThemba project might be conceptualized as a gesture toward a potential technopolitics of postapartheid: it functions as a tool and as a symbol, both within South Africa and as a focal point for outsiders. For both South African political leadership and the South

African and international scientists that came together to found iThemba, science and technology generally and drug discovery science in particular became sites for nation-building.

South Africa, pharmaceuticals, chemistry, international exchange

Science under Franco: Isolation and international connections among psychologists

Annette Mülberger, Universitat Autònoma de Barcelona

Historians often consider that Spain was culturally isolated in the post-Civil War years, with historians of psychology echoing this idea of Spain's isolation and reporting a regression in psychological science in Spain at that time. My research critically examines the extent to which psychologists really were isolated at that time, and whether their scientific and professional praxis can be considered out-dated and limited to Spanish traditions. Psychologists were one of the first scientific communities to organize international conferences and societies back in the 19th century. From the start, Spanish delegates were eager to be part of this initiative, attending regularly, presenting research from their country, promoting Esperanto, and forming part of different committees. In general, the first few decades of the 20th century represent a period of openness, with Spanish scientists in contact with foreign scientific development and acquiring some prestige. After the outbreak of the Civil War (1936), the situation changed dramatically. The years after the war (which ended in 1939) were years of penury, economical autarchy, military terror, and censorship. The universities deteriorated, former scientific institutions closed and many leading psychologists had died or were in exile. When the Second World War ended, Spain was starting to recover. The gradual easing of the Franco regime offered new possibilities for the revival of sciences such as psychology within the academic system. This was a time when the Spanish government was in alliance with the Catholic Church. In these circumstances, the restrictive regime declared "neo-scholasticism" the official doctrine in education, leading to a revival of Aristotelian and Thomist psychology. Nevertheless, other branches of psychology were also pursued, with differential psychology and psychometrics being one of the most important. My research looks at how and to what extent Spanish psychologists tried to meet the demands of the Catholic dogma and how, at the same time, they attempted to keep up to date with modern science, and foreign techniques and approaches. Therefore, I explore the professional and intellectual relations Spanish psychologists maintained or established in the 1940s and 1950s with their colleagues abroad.

dictatorship; Catholicism; differential psychology; knowledge in transit; Spain

General System Theory: Perspectives

Antônio Carlos Victor Amaral, UNEC - Centro Universitário de Caratinga

This paper was rooted in the development of an analysis based on the discussions and resulting considerations of Ludwig von Bertalanffy and Kenneth Ewart Boulding on the System General Theory (TGS) in correspondence exchange and their records in the yearbooks of the Society for General Systems Research, from its foundation until 1972. We sought to establish methodological and historical landmarks in the development of System General Theory and the respective interdisciplinary knowledge and its contribution to the progress and results of this analysis. With the documentary research is concluded that discussions between two professionals from different backgrounds and with similar and contemporary findings in the construction of System General Theory and its theoretical applications.

The Health of our Population: the divulgation of science in the fields of non-formal education

Antonio José Silva Oliveira, Universidade Federal do Maranhão
Ana Lourdes Alves de Araújo, IFMA

This article is the work developed in the research group Scientific Culture and Knowledge Production, Educational Program Graduate Education of the Universidade Federal Maranhão, which focuses its research on science communication, science popularization and public understanding of science, terms used in this work with the same sense, in order to find similarities between the actions of promotion and education. To this, we used oral history as methodology, since in this aspect of qualitative research can explore the relationships between history and memory, which constitutes the essence of this research. The construction of history and memory of the programs is Life Food and Health of Our People, broadcast on Radio Educadora do Maranhão, in the 1980 and 1990 were made through dialogue with the sources: narratives of persons, tape recordings programs, among others, came under the theory of Freire's Popular Education and non formal education scholars such as Maria da Gloria Ghon allowed us to see that these radio programs consisted non formal important tools of education, because they become dynamic actions which dealt with scientific knowledge as social practice, allowing that the science became part of everyday life in the periphery and the rural community of Maranhão.

Science Communication; Science and technology; Non-Formal Education; History of Science in Maranhão

Experiments with ectoplasm in France of 1920 at the Institut Métapsychique International

Antonio Sucena Leon, Universidade Federal do Rio de Janeiro

This paper aims to be a reconstruction of the institutional history of Institut Métapsychique International, based on ectoplasm experiments conducted by the Institut in the 1920s and by its predecessor Gustav Geley's laboratory, located at the Suffren Avenue in 1918. This study suggests the existence, in this period, of two schools of metapsychique, the French School and the English School. The objective is to question the truth of the experiments and, based on primary sources, identify if there was any evidence of fraud. This paper also aims to understand the reasons for the subsequent decrease in research on ectoplasm. The applied methodology analysed primary sources such as letters, documents, speeches, magazines and books from the time. The results pointed out to two metapsychique schools, one French linked to the phenomena called objective, and the other a English school linked to the phenomena called subjective or intellectual. I concluded that the primary sources didn't show any evidence of fraud from the mediums. I've also concluded that the decrease in the experimentation with ectoplasm at the Institut Métapsychique International occurred due to the change of the Institute's directors board, after the death of Gustav Geley. His substitute Eugene Osty was more inclined to consider the English School of metapsychique and the subjective phenomena.

History of Institut Métapsychique International; ectoplasm, Metapsychique, paranormal

Race and Medicine: The curious relationship of the Army and Medical Services in the Madras Presidency

Arnab Chakraborty, University of York

This paper will extend the study of colonial medicine and discuss the impact of 'caste, class, religion and race' in the army recruitment policies in the Madras Presidency. There has been a long debate about the process of labelling the Indians by the colonial government, and through my paper I will show how the process changed over time. I will explain how religion and race became the determining factor behind the army recruitment policy in the region. The army recruitment policy made a lasting impact on the medical scenario in the presidency and I will, through this paper show how the Army services and Medical services were interlinked to facilitate a massive change in the perception of the people in Madras. This paper will look beyond the Madras city to compare the urban and rural part of the region giving importance to the various medical services providing health care in the presidency. The period is particularly significant in the context of the Colonial Madras as it experienced a major shift in the state policies towards medicine during this time. The paper will examine the contribution of medical service officers and their role as intermediaries in the rural areas of the presidency, this eventually blurred the difference between serving in the Army medical department and the civilian ones. Finally, this paper will examine the reception of the western medicine by the medical market place which was developed in colonial Madras.

Colonial Medicine; Army; Medical Services; Race

Biology 1870-1910: What does it mean to inherit and conceive in the German Empire and the US?

Bettina Bock von Wülffingen, Humboldt-University, Berlin

According to geneticist Johannsen the notion of inheritance in biology was taken from that in global terms very different forms of inheritance exist?

This talk presents results of a study of the conceptual interconnection and parallels between the development of legal codes of inheritance and family law between 1870 and 1900 on one hand and on the other the establishment of ideas of material inheritance of biological traits that took place during this time in Germany.

Internationally, German hereditary science lead the global field at the end of the nineteenth century, whereas after 1900, with chromosomal studies, researchers from the United States took over. Thus the contrast between the German and American research in heredity and conception helps to sharpen the understanding of contingencies. Quite different socioeconomic and cultural environments of scientists in Germany and by contrast in the USA deeply influenced how they approached their scientific investigations and the assumptions they made. In particular, changes in German inheritance laws profoundly shifted how they thought about maternal, paternal, and parental rights and the identity of their offspring.

Inheritance conception 19th century German Empire USA

Tracing Drugs from the East : A European Court Pharmacy in 16th and 17th Century

Bettina Wahrig, Braunschweig U of Technology, Dptmt. History of Science and Pharmacy

The Ducal Court Pharmacy at Wolfenbüttel provides ample archival evidence of the global exchange of medicinal substances (1576-1716, cf. Wacker 2013). Archival material and a documenting data-base provide us with informations about the everyday use of pharmaceutical products by the ducal family and their entourage. Preparations of plants – for example of cinnamon, ginger, nutmeg, or poppy – went into the hundreds. The data-base reveals preferences of the court members for certain substances and preparations. It provides us with knowledge about the dealings of the court physicians and -apothecaries, and about pharmaceutical practice during more than two centuries. This can help understand pre-modern concepts of healing, and their changes over time.

My paper will focus on the most preferred substances from East and South East Asia, their uses and their users: The documents about the day-to-day dealings with medicinal substances and the interactions between the court and its pharmacy show that the substances were markers of distinction. Drugs were marked (and became markers of distinction) by way of their preparation and presentation, by the occasions of their use, by their forms of application, by their ingredients, by the circumstances of being called for, prescribed delivered, passed on etc..

The paper will follow the lead of the following questions:

- Most ordered drugs from East and South East Asia,
- changes in the popularity of some of these drugs,
- most important indications of their use,
- most popular preparations (e.g. decoctions, distillations, unguents, fumigations).

Was there any comparative knowledge concerning the use of medicinal drugs in European and the East Asian cultures (e.g. European vs. Asian Angelica root, use of paeonia, use and signification of incense)? What do we know about the knowledge of the court physicians and pharmacists – or other members of the court – concerning the origin and use of these drugs?

Chinese medicine, Court pharmacy, Early modern pharmacy

Relocating Popular Response: Burdwan Fever in Lower Bengal (1860 – 1943)

Binata Sarkar, The University of Burdwan

The proposed paper attempts to focus on the people's response to health care system including the prophylactic in connection with the control of epidemic fever in Lower Bengal. In the second half of the nineteenth century, Lower Bengal (a part of Eastern India) had experienced devastation caused by an epidemic fever, known as Burdwan Fever. The common people including the intellectuals and indigenous medical practitioners responded to colonial medical intervention in their own ways. It is argued that most of the common people were ignorant and therefore preferred to suffer in silence. Some believed in the efficiency of the prophylactic used and also its side-effects including renal problem, sexual impotence and sterilization. More, importantly even the doctors were not so liberal in using quinine in all cases, particularly for the pregnant women, as they believed that it would result in abortion. It is equally true that the people of Lower Bengal were not culturally opposed to quinine or colonial medical intervention. It is evident that many of them walked for miles and stood in the queue for a long time in hospitals for quinine. Besides, Baboo Lall Missree, Baboo Jotendra Mohan Tagore, Baboo Bhagaban Chandra Bose, the British Indian Association, Voluntary organizations and the Maharaja of Burdwan promoted sanitary measures introduced by the colonial government in the form of cutting of jungles, filling up of borrow pits and kerosinization of tanks and water pools. In addition to these educational posters, charts and pamphlets on various health

subjects supplied by government and non-government organization to control fever received positive response from the various sections of the society.

An attempt would thus be made to illustrate how the people in Lower Bengal received and appreciated western medicine and British health care system in the context of Burdwan fever. This paper would supplement the findings made on the people's response to diseases and medicine in India in general and enrich the literature in the arena of social history of medicine. This article is based on the primary sources consulted at the National Library of India and State archives of West Bengal, India and on the literary sources available in the different libraries. It has also been formulated after vibrant interaction with the scholars working on medical history.

prophylactic; response; medical intervention; devastation

History of the Case of “Bamboo Flowering” and “Save the Giant Panda” in 1980s China

Bing Liu, Institute of STS, School of Social Sciences, Tsinghua University

This article examines the history of the 1980s “bamboo flowering” phenomenon and “save the giant panda” activity from a perspective of science communication. We study the way that ecological knowledge is communicated and constructed socially and the way the ecological system is narrated. In China, the national treasure of wild pandas are the most popular yet high-profile extinct species, thereby they possess social and ecological significance of our era. However, for that historical case, scientists still have a debate over whether the flowering of the bamboo threatens the survival of pandas. In this paper, we want to use the “save the giant panda” activity as a historical case study to show how such a wildlife protection is triggered by a natural phenomenon called the bamboo flowering. “Save the giant panda” brought the long-term effects on giant panda protection and wildlife conservation. We argue that “save the giant panda” activity in relation to the bamboo flowering phenomenon is worth studying from a science communication standpoint, as it shows an interlaced discourse between the science/ecological and the social and political. Therefore, it reflects complicated interactions between science, technology and society.

Giant panda; Bamboo flowering; Save the giant panda; Science communication; Conservation

Alexander Luria at the Burdenko Neurosurgery Institute

Boleslav L. Lichterman, The IM Sechenov First Moscow State Medical University

Alexander Romanovich Luria (1902-1977) is internationally known as a founder of neuropsychology. Aim of presentation: to overview approaches of A. Luria and his school to restoration functions of damaged brain in a neurosurgery clinic in a historical perspective.

Materials and methods: published and archival sources related to Luria's work at the Burdenko Neurosurgery Institute in Moscow.

Results: A.R. Luria, being a professor of psychology, obtained his medical degree in 1937 and spent two years at the Central Neurosurgery Institute (later renamed the Burdenko Neurosurgery Institute). In his memoirs he considered this period “the most fruitful in my life”. From September 1947 to December 1951 A.R. Luria was employed at the Burdenko Neurosurgery Institute where he created and directed a laboratory of experimental psychology of Academy of Medical Sciences of USSR. At the so-called Pavlovian session of Academy of Sciences and Academy of Medical Sciences in 1950 A.R. Luria criticized himself for linking psychological facts and localization of cerebral lesions in

his books "Posttraumatic Aphasia" (1947) and "Restorations of Brain Functions after War Injury" (1948). In the wake of the so-called "Doctors' affair" all Jewish specialists had to be fired from medical institutions. In December 1951 Luria was fired from the Burdenko Neurosurgery Institute and his laboratory was disbanded. Luria protested and cited Pavlov who favored fusion of psychological and physiological research. After Stalin's death Luria was allowed to return to the Burdenko Neurosurgery Institute as an external consultant neuropsychologist. He used clinical material for diagnosis of brain lesions and development of methods of neurorehabilitation. Conclusion: Moscow Institute of Neurosurgery was one of birthplaces of neuropsychology as a separate discipline.

Alexander Luria, neuropsychology, history of neurology, USSR

Changing the theory of neurotransmission from the periphery: How global exchanges and local interactions prepared John Eccles for Karl Popper's concept of falsification

Borck, Cornelius, Inst. Hist. Med. and Sci.Studies; Univ. of Lubeck

The "war of the soups and the sparks," whether neurons communicate via chemical mediators (soups) or electrical signals (sparks), was decided in a famous experiment in 1951. John Eccles defeated his own theory of electrical transmission, because he had been inspired to do so by Karl Popper and his concept of falsification, while they both lived in New Zealand. This well-known episode from the history of neurophysiology counts as a rare instance of philosophy of science advancing scientific research. The presentation revisits this famous episode as a site for a material history of the practices involved in experimental research. It will show how Eccles' intellectual mobilization was based on the worldwide travel of people, ideas, instruments, preparations, and techniques, on the one hand, but also grounded in a series of very local and contingent interactions, on the other. Contextualizing Eccles' "Saulus-to-Paulus" conversion (Henry Dale) in the larger trajectories of the controversy and the many dislocations involved in it, the paper presents the debate on the episode as a test case for a fruitful dialogue between philosophical and historical epistemology.

History of neuroscience, neuronal communication, travel and migration, falsification, historical epistemology

Thomas Melvill and the floating drop: a study of his short career in optics

Breno Arsoli Moura, UFABC

In the 1750's, the young Scottish natural philosopher Thomas Melvill (1726-1753) presented two studies on optics, published in the Philosophical Transactions in 1753 and in the Medical Society of Edinburgh, in 1756, posthumously. These two studies had significant repercussion at that time, although were not completely accepted. Joseph Priestley (1733-1804) mentioned him frequently in his historiographical account for optics, *The History and Present State of Discoveries Relating to Vision, Light and Colours*, published in 1772. In these two reports, Melvill contested some classic propositions of Newtonian optics, although he was a projectile theorist. One of his critics concerned the idea that each colored ray was composed by light particles of different sizes, very common among Newtonians, and that was the reason for their different refrangibility. Melvill believed that this difference was due to their distinct velocities, not the size of their particles. He also proposed new ideas about inflection and attempted to explain why light particles would not hit each other,

besides other subjects. In the 1756 paper, Melvill presented a curious discussion about a floating drop. He believed that it could prove the existence of repulsive powers between bodies. By analyzing the reflection of light in a drop over leaves of coleworth, Melvill assumed that occurred in it a total internal reflection, because it was floating over the leaves. Melvill's explanation was mentioned by Priestley and also by John Robison in his article for the Encyclopaedia Britannica in 1797, but it not seem to have a wide repercussion. Historians of 18th century optics often cite Melvill's works, like Geoffrey Cantor, Henry Steffens and Casper Hakfoort. However, none of them bring a detailed analysis of Melvill's ideas and none mentioned his curious study of the floating drop. In this communication, I will present a detailed study of Melvill's works and ideas, bringing to light an interesting natural philosopher long forgotten by modern historiography and enhancing his importance to the history of optics in 18th century.

Melvill, optics, 18th century, light

Dredging up the Hassler expedition

Bruno Gabriel Costelini, Centro de Estudos do Mar, Universidade Federal do Paraná

Between 1871 and 1872 Professor Louis Agassiz, then one of the foremost naturalists working in America, led a deep-sea dredging expedition aboard the US Coast Survey Steamship Hassler, circumnavigating South America in search of evidence to support his anti-Darwinian theories. Though largely considered a technical failure and a fitting coda to Agassiz's declining career, we'll argue the cruise represented an important step in the development of sounding and dredging techniques, besides amassing a wealth of specimens that would fill the collections of many a natural history museum.

In order to reevaluate the expedition's place in history we need first to establish its narrative. With this purpose we gathered all journals, letters and public records left by the members of the party, which included former Harvard President Dr. Thomas Hill, Agassiz's wife Elizabeth Cary Agassiz and the student and artist James Henry Blake, besides official documents and correspondence by Louis Agassiz himself. All of these primary sources help to build an intricate story of the endeavor.

Analyzing then the scientific papers and articles that were originally published at the time we can reposition the importance of the collected data in the context of 19th century marine and evolutionary science development. Also, by looking further into more recent scientific literature produced from the stored specimens we can project the influence of the expedition into contemporary science.

With this whole effort we hope not only to shed new light into a somewhat forgotten chapter in the history of science and scientific exploration but also to reposition the Hassler expedition's place in those fields. Generally overshadowed by the immediately following 1872-1876 Challenger expedition, the Hassler played a larger role in the development of marine science than has been accounted for, as we will attempt to demonstrate with this investigation.

"History of Oceanography"; "Hassler expedition"; "Louis Agassiz"

The cabinet and the book: models in natural history and the nature of Brazil, 1541-1605

Bruno Martins Boto Leite, Universidade Federal Rural de Pernambuco

From 1541 to 1558, the swiss naturalist Conrad Gesner composed and published important works about plants and animals, the "Enchiridion Historiae Plantarum" and the "Historiae Animalium". He

was one of the first naturalists to compose natural history using information brought from New World. Nevertheless, in 1559, all of his works had been forbidden in the pages of the Index Librorum Prohibitorum because of his adhesion of protestant creed. Beside this, the italian physician Ulisse Aldrovandi started to gather things to compose a cabinet of curiosities and to study animals and monsters. He collected a vast amount of plants, animals and strange things from all over the world and wrote important books about it. The natural history of Gesner and Aldrovandi, after the forbiddance of the Index, became two different and antagonic models of natural history in the protestant and catholic worlds. The aim of this work is, therefore, to compare the principles of the works of Gesner and Aldrovandi in order to observe the characteristics of both paradigms. We will use as a term of comparison the descriptions done by both naturalists of animals and plants of Brazil.

History of Natural History; Science and Religion in the Early-Modern Science; Catholic Science; Protestant Science

Superiority Reversing of Sino-Western Firearm Technology: World Firearm Technology before 1840 in a Comparative View

Cai Jue, School of Humanities and Social Sciences, National University of Defense Technology, Changsha, China

Gai Lige, National University of Defense Technology

Relative superiorities of Sino-Western firearm before 1840 are studied in three stages in this paper. From the early 10th century to middle of the 15th century, as a precursor China dominated the firearm technology incontestably; from middle of the 15th century to the late 17th century, firearm advanced rapidly in western countries while it declined in china. However, due to the comparatively frequent communication between China and west, and the experiential nature of western firearm technology during that time, there was not a substantial gap before the end of 17th century. Since then, western firearm technology had been soaring based on modern scientific theories, yet development of Chinese firearm technology had almost stagnated because of certain reasons. With an increasingly wide gap, Chinese and western firearm technologies went into separate ways.

Sino-Western Comparison; Firearm History; Superiority Reversing

On the Style of Medical Gaze. Epistemological Basis for a Scientific Iconography in Ludwik Fleck's Theory

Carlos Hugo Sierra, University of Basque Country & Open and Distance National University

The guiding intention of this paper is to expose some of the central and major ideas related to the epistemological exploration of scientific image which was developed by the Polish medical microbiologist Ludwick Fleck in the late 1920's. L. Fleck carry out an original interpretation on the main philosophical and sociological avant-garde theories of knowledge (conventionalist philosophy, phenomenology, European sociology of knowledge or Gestalt psychology) which allow him to analyse the nature of scientific praxis. In this sense, it is important to highlight that, in accordance to his constructivism approach, the scientific theories and even empirical discoveries rest on a specific thought-style which, as a guided perception by psychological, social and historical factors, reflects the predominant perspective or, in other words, the way of seeing the world, of a concrete historical period. We must to take into account that this thought-style not only determines the theoretical elaboration of a scientific proposition or, even, the genesis of an empiric object, but also the

gnoseological and material conditions for the instrumental observations of the reality. From this point of view, it is worth to underline that one of the most significant contributions made by Ludwick Fleck's reflexive theory to contemporary epistemology have to do with his original insight concerning the construction's process of scientific observations and their representations. Thus, according to Fleck's hermeneutical approaches, the scientific iconological criteria not only are strictly conditioned by the instrumental scope and capacities of seeing the reality developed by the technological advance, but also we have to be aware that the conventional activity of the scientific community in terms of making empirical knowledge, the thinkable or experienceable definitively is co-determined by a pre-existing scopic regime which historically is changing and subliminally articulates the horizon and boundaries of visibility and invisibility in relation with the scientific object. As a consequence, this presumption allows L. Fleck to reevaluate the longstanding status and nature of the medical illustration along the course of the history of western medical perception, insofar as his epistemic analysis re-includes the rhetorical, aesthetical and symbolic codes and values into the modern medical imaging that, under this distinctive perspective, is converted into a kind of ideogram.

Medicine, epistemology, image, thought-style

Dialogues transatlantiques célestes. Les extases interplanétaires de Athanasius Kircher et de Valentin Stansel au XVIIe siècle

Carlos Ziller Camenietzki, Instituto de História/UFRJ

Dans la deuxième moitié du XVIIe siècle, deux dialogues célestes importants ont été publiés en Europe. Tous les deux. Tous les deux ont été écrits par religieux de la Compagnie de Jésus: l'un était le Père Athanasius Kircher, assez actif à Rome; et l'autre était le Père Valentin Stansel, missionnaire à Salvador, Bahia. Kircher a fait publier son *Iter Exstaticum* en 1656 et Stansel a fait imprimer son *Uranophilus Celestis Peregrinus* à Gend, en 1685. La ressemblance de forme littéraire et des objectifs des deux ouvrages permet également de poser des questions sur les variations littéraires et scientifiques des livres écrits dans des cadres sociaux et culturels aussi différents. En fait, Kircher travaillait au Collegio Romano, institut modelaire de la Compagnie de Jésus dans la capital culturelle et diplomatique du monde, et il était en contact direct avec les principaux débats philosophiques de son époque. Par contre, Stansel vivait dans Salvador, capital de l'Amérique Portugaise, et travaillait dans le collège des jésuites de la ville. Cependant, le missionnaire démontre d'être au courant des débats scientifiques les plus sophistiqués de la fin du XVIIe siècle. Ainsi, on peut vérifier de l'efficacité du réseau de communications philosophique de la Compagnie de Jésus, mais aussi voir que la situation géographique privilégiée de Stansel, la bonne qualité de ses observations et sa réflexion particulière l'ont mis en contact direct avec les alternatives scientifiques en discussion au XVIIe siècle.

Fiction astronomique; Dialogues philosophiques; Astronomie des jésuites; Science et colonisation

Calendars and the Mayan time: an astronomical and sociocultural aspects based analysis

Carolina de Assis Costa Moreira, Universidade Federal do Rio de Janeiro
Rundsthen Vasques de Nader, Universidade Federal do Rio de Janeiro

Of all the abstract concepts that pervade human existence, time is perhaps the one that has been studied diversely. Referenced from the movement of the stars, its perception is unique to each society, shaped by its various social facts, having been incorporated into the time registers designed

by the cultures. Among the greatest civilizations in human history, the Mayas, inhabitants of a area known as Mesoamerica, were those who most has used their conception of time in all sectors of society, creating a dependency relationship with this concept wich is rarely found in other culture. Interestingly, the literature on the study of the Mayan calendar, although plentiful, has treated generally about the origin and description of the functioning of these calendars without contextualizing them with multiple cultural aspects. Thus, although the structure of the Mayan calendar has been well known for centuries, issues intrinsic to its operation, as the source of its annual period and the absence of its assessment to natural cycles, for example, remain subject of intense debate in the literature. This works investigates how the notion of historicity, the religion and agriculture as means of livelihood worked together with Astronomy in the construction of the Mayan conception of time which is reflected in their time registers. The results demonstrate that a collaborative analysis of these factors allows the construction of a scenario that not only justifies the specifics of the Mayan calendar, but allows the establishment of a new hypothesis for the origin of the oldest and least known of the three calendars, the Tzolkin.

Time; Archaeoastronomy; Mesoamerican Calendars; Mayan Civilization

Communication strategies beyond experts: the case of centenary medical journals The New England Journal of Medicine and The Lancet

Carolina Medeiros, Unicamp
Germana Barata, Unicamp

The medical journals, The New England Journal of Medicine (NEJM) and The Lancet have been published for nearly 200 years uninterruptedly and have a high Impact Factor (JCR, 2015) - both considering the ranking of the medical journals or all other fields journals. They are known by non-expert public and are frequently present in the mass media. The aim of this paper is to analyse the communication strategies adopted throughout the history of these journals and their goals. This research is based on the collection of documents and publications that register the main transformations through which journals have passed, with emphasis in the late 1990s, when online editions appeared.

The NEJM set up in 1812, and The Lancet in 1823, had the same initial mission: to be a source of information for experts. While the American NEJM was created inside a teaching and research institution with a strong purpose of fostering medical training, the British The Lancet was strongly influenced by its founder, the physician Thomas Wakley, who had perceived a need for dialogue between experts and decision-makers in order to promote medical reform in the country.

Despite the highly academic objectives, the journals publish papers that generate great social and media interest such as the first researches with vaccines and antibiotics (1940), pioneer reports on the insulin use (1922); the association between smoking and lung cancer (1928), early diagnosis of syphilis (1891), Aids (1981), and the controversial study linking the cause of autism in children to the triple viral vaccine (1998).

In 1996, NEJM started its website and two years later The Lancet did the same. The journals began transferring their content from paper to screen and know use well the multimedia potential to increase the visibility of their contents. They opened accounts in the main social networks in the world: Twitter (both in 2009), Facebook (2010) and Youtube (2012), in addition to the former production of press releases with embargo policy for journalists to guarantee broad and simultaneous dissemination of their contents. They also have widen up the open access offer. The constant exposure to society, decision-makers and academics combined with weekly issues, the focus on general medical issues and the prestige they have earned guarantee visibility and credibility that keeps the Matheus effect in full operation.

academic publishing; medical journals; science communication; sociology of science

Deep brain stimulation: a new frontier in the field of psychiatry?

Cherici Céline, upjv

Acting on the brain through physical electrical or magnetic means meets growing interest in neurology and psychiatry. Is our brain an electrical machine in which we can modulate the pathological behavior? This philosophical question seems to receive a positive answer in some contemporary practices. This, in turn, raises the following question: does it even still make sense to differentiate between psychiatry and neurology? In this paper, we will address this question by looking at the way through which DBS has been introduced in medical practice.

Deep Brain Stimulation; medical practices; philosophy of neurosciences

The history of the formation of the space remote sensing: internal and external military-political motives

Chesnov Vasily, S.I. Vavilov Institute of History of Natural Sciences and Technology of Russian Academy of Sciences
Shirokova Vera A., IHST RAS

Remote sensing from space is the study and observation of the planet's surface with the help of space vehicles. The results are used to study natural resources, meteorological and other purposes. Under the "other purposes" usually refers to aspects of military applications. It is this area of application of space assets played a crucial role in the development of space remote sensing. The era of studying the Earth by space remote sensing began with the 4 October 1957 launch the first Soviet artificial satellite of the Earth. Its radio transmitter demonstrated the possibility of electromagnetic probing of atmosphere and ionosphere of the earth.

By the mid-1950s, it became apparent that it is possible to create an artificial satellite for photographing the surface. In February 1958, the United States was adopted the program "Corona". In August 1960 it was delivered to Earth the first film. The first Soviet remote sensing spacecraft was also equipped with photographic facilities. Military Department initiated the creation of the first space systems of Earth remote sensing in the USSR, and in the United States. Political motives and the space race between USSR and USA contributed to the intensive development of remote research: who will do the first pictures back of the moon, the surface of Venus, the Martian "canals". Each of these achievements had contributed to strengthening the political image of the system.

However, it is possible to talk about the widespread deployment of sensing of the Earth from space only since the mid-1960s. That fact is explained by several factors. First at that time intensified the launches of spacecraft into Earth orbit were intensified. Second, in these same years there has been rapid progress of radio engineering, microelectronics, and other technologies. Remote sensing from spacecraft beginning to take shape in independent scientific and technical direction in the short term. Further successful development of remote sensing is associated, primarily, with its advantages over other methods of study of the Earth.

1. Obtaining quantitative information about objects or areas of objects, where contact measurements are not feasible or difficult.
2. The coverage measurement of large areas without a network of local devices, communications, etc.
3. The possibility of obtaining data averaged over the line, area or volume.

Remote sensing; space; policy; history

Contraceptive hormone implant research in Brazil: a good case to study local styles of scientific thought

Claudia Bonan, IFF/Fundação Oswaldo Cruz

Claudia Bonan, IFF/Fiocruz

Andreza Nakano, IFF/Fiocruz

Luiz Teixeira, COC/Fiocruz

Ana Pimentel, IFF/Fiocruz

In 1984, the Ministry of Health authorized the participation of Brazil in international multicentric research with the hormonal contraceptive implant Norplant®. Two years later, amid denunciations of irregularities, the authorization was canceled and the investigation suspended, surprising the researchers and generating controversy, since other tests with hormonal implants had been carried out in the country for two decades without any official license.

We present a study about the development of hormonal implants in the 1960s and 1970s, with emphasis on the participation of Brazilian scientists and the role of Brazil as a testing field. Its purpose is to analyze the construction of thought styles about scientific activity, including ideas about autonomy and social purposes of the products of science, from scientific articles published in international journals between 1966 and 1986.

The contraceptive hormone implant routes in Brazil precede the authorization / suspension of Norplant research. In 1967, the Population Council brought together researchers from several countries to develop a subdermal hormonal contraceptive, with important participation of Brazilian scientists. Scientific innovations and political contexts contribute to the initiative: the possibilities opened up by the synthesis of new sex hormones; The development of silicone materials for medical purposes; The scenario of euphoria with the rapid diffusion of contraceptive pills; The neo-Malthusian debate on the demographic crisis.

In the analyzed scientific articles, the researchers reiterate the idea of the opportunity of a long-term contraceptive and bet on the improvement of the hormones and their forms of administration. The belief that they can become ever more effective and safe feeds the spirit of innovation. Safety, efficacy and reversibility lead scientists to take their acceptance for granted. For them, their researches find legitimacy in their scientific rigor, in their ethical rectitude and in the social contribution they can give.

The conviction of the existence of the "demographic crisis", the certainty of the importance of medical control of fertility management, the idea of opportunity of an effective and long-lasting contraception, and a liberal idea of the autonomy of medical-scientific research are part of a style of practices and thought that made possible the development of implants, but that made it impossible to stabilize in the country in the 1980s.

Hormone Implants; Contraception; Thought style; Scientific research; Brazil

The Relocation and Adjustment of the Academic Divisions of the Chinese Academy of Sciences, 1979-1984

Cong Wang, University of Chinese Academy of Sciences

After the Cultural Revolution, the importance of the Academic Divisions of the Chinese Academy of Sciences attracted attention again. Its members' conference was relocated as the highest decision-making body of the Chinese Academy of Sciences. However, the new location could not meet the demands of the Party and the country at that time. Later, the function of the Academic Divisions was

adjusted to scientific consultation. This paper presents the relocation and adjustment process of the academic divisions from 1979 to 1984 by 4 parts, and further discusses the characteristics of the decision-making procedure and the effects of different actors. At the end, this research explores the problem of the balance between academic authority and party-administrative authority, and then offers some ideas for the further Scientific and Technical Structural Reform in China.

the Academic Divisions; academic advisory; scientific research system

From wireless telegraphy to broadcasting. Technological appropriation of the radio in Chile, 1901-1931

Cristóbal Quezada Herrera, Universidad de Chile
Martín Pérez Comisso, Universidad de Chile

This paper presents a review of radiophonic's origin history in Chile from a technological theory. Before a traditional history marked on the personal initiative of Arturo Salazar and Enrique Sazié, we approach by major depth on the political, technical, academic and social processes of the technological appropriation of wireless telegraphy that lead to the first radial transmission in 1922, promoted by Chile Radio Club.

We exposed a large theoretical discussion of Technology-Society relations and we proceed to the original proposal for the study of technology appropriation so called "Rational Model of Technology Appropriation". The model has been contrasted to evidence obtained from academic, journalistic and legal documents as well as pertinent bibliography referred to technical topics and previous studies of the radio in Chile and Latin America.

As conclusions, the origin of the radio is now understood not like a milestone fundacional but like a process of technological appropriation of the wireless telegraphy in which diverse actors, from different areas, constructed an ambience inclined to the broadcasting. On the other hand, the technological appropriation of radiophonics is tackled, with its peculiarities, emphasizing the position of the actors in the different dimensions of the proposed model.

Technological appropriation; Wireless telegraphy; Broadcasting; History of Technology; Rational Model of Technology Appropriation

Institute of Applied Physics, CAS and "1956-1967 Long-term Planning of Developing of Science and Technology" in China

Dai Lingqing, University of Chinese Academy of Sciences

"1956-1967 Long-term Planning of Developing of Science and Technology" (Twelve-year Planning, TYP), outlined by Chinese scientists for several years in the first half of 1950s, has played an important role in the development of modern physics in China. The original documents, which are related to the scientific planning in the Institute of Applied Physics, Chinese Academy of Sciences (IAP, CAS), especially "The draft of Long-term Planning of Physics "(1956) and "Summarizing Opinions on the Planning of the Discipline of Physics in Basic Science for the Scientific Planning Committee of the State Council of PRC"(1956), are slightly different from the final version in TYP. The detailed contextual analyses have revealed that the differences in versions have been the results of the interaction between the scientists' scientific backgrounds and the social reality, the scientific thoughts and the infrastructure of modern industries of China in time of 1950s, when IAP, regarded

as the most important institution in physics has determined the developmental stages of the Chinese physics in the second half of the last century in China.

Twelve-year Planning; Institute of Applied Physics; Modern Physics in China

Galileo Galilei in the Seventeenth-Century Opera. Science, religion and politics

Daniel Martín Sáez, Universidad Autónoma de Madrid

In 1610 Galileo Galilei published the *Sidereus nuncius*, in the same court where, two decades earlier, Emilio de' Cavalieri and Laura Guidiccioni had performed the first fully-sung pastoral play, which reached its culminating point in 1600, during the nuptials of Maria de Medici and Henry IV, when two melodramas were made. Galileo's arrival at the court ten years later, with the publication of his first observations through the telescope, seems to revive a genre that, with the sole exception of 1602, had stalled in Florence, continued on to Mantua and Rome. In 1613, Galileo had already described the phases of Venus, certain anomalies in Saturn, the mountains of the Moon, the satellites of Jupiter and sunspots, among other findings. That same year, the new Galilean physics finds its first theatrical representation in a Florentine opera. It was repeated the following year in Rome before a public of religious personalities. Here, the "stelle medicee", the greater emblem of the Heliocentrism, but also of the power of the Grand Dukes of Tuscany, appeared on the stage, acting and singing. We have several sources of both representations. It can be observed how this work was received between the courtiers and religious personalities. It is very useful in order to understand the complex relations between Galileo and the Church. From that moment on, the Medician Stars emblem was used in the edition of several printed florentine sources, even after the condemnation of the Copernicanism of 1616, including two religious operas made during the regency of Cristina de Lorena (whose relationship with Galileo had been so important) and Mary Magdalene of Austria. Galileo's connection with the opera, however, finds its culmination in Rome, where an important Galileo's opponent, Orazio Grassi, had also made the libretto of an important melodrama. After the trial of 1633, during the papacy of Urban VIII, we find three operas related to Galileo, all sponsored by the papacy. Two of them are written by Cardinal Giulio Rospigliosi, the future Pope Clement IX, and offer us an image of Galileo (on the part of the Church) more ambivalent than is sometimes supposed. We will analyze these operas according to the religious, political and scientific context in which they were born, as a unique example to understand the complexity of the Modern Age.

Science; Religion; Church; Opera; Seventeenth-Century

The Planning Of The Porto Alegre Metropolitan Area Based On The Technical Cooperation Between Brazil And The German Federal Republic (1963-1978): urban models and transfers of ideas

Danielle Heberle Viegas, UNILASALLE

The creation of the metropolitan areas in Brazil was mainly linked to the time frame set by the Military Dictatorship (1964-1985). One of the key State strategies of action at the time was the growth of the urban planning scope through technical and technological promotion, made possible via international cooperation. Regarding such considerations, this paper presents the history of the Porto Alegre/RS Metropolitan Area, whose planning was conceived through the Technical Cooperation Deal between Brazil and the German Federal Republic/GFR. The specificities that the international technical cooperation brought to the making of the Metropolitan Development Plan

have been analyzed, reaching the aims of identifying the institutions, the models of the projects and urban ideas, the agents and motivations within Brazil and the GFR, between 1963 and 1978. The main hypothesis suggested regards the generation of a transnational sphere of knowledge sharing which peaked in the flexibilization of notions such as welfare state and underdevelopment, which provided guidelines for the cooperation acts in a post-war world. In this regard, it was discerned the extent of which the circulation of ideas about urban planning in the 'third world' was subject to adaptation and ruptures when linked to the authoritarian and developmental Brazilian project.

Porto Alegre Metropolitan Area - Technical Cooperation - Brazil-Germany Relations - Urban Planning - Military Dictatorship

Decipher to 'First-class bow has six nice performance' in Mengxi Bitan

**Degang Yi, Inner Mongolia Normal University
HU Aijing, Huhhot Vocational College**

Chinese traditional archery is one of 'six skills' named by Confucius. Technology of making traditional bow with three kinds of natural elastic material including wood, sinew and horn was been noted down at the book named Kaogong Ji with many every life technologies together. One thousand years later, Sheng Kuo wrote down similar accurate description sentences, 'there are six nice performance for first-class bow (弓有六善)', in which introduce how to evaluate one first-class horn bow at his book Mengxi Bitan after he carefully watched detail of his brother making horn bow. But the same sentences were been found in book named Shejing(射经) which Wangju wrote before two hundreds year earlier. Some scholars said that the view of 'there are six nice performance' at Shejing should been added by copying Mengxi Bitan text. On the other hand, there is some scholar published article said that it come to Zhouyi(周易) text. Actually, it is more important problem to accurately understanding or decipher 'there are six nice performance' text with modern language, because it directly relate to how to restored a nice horn bow by modern methods with traditional material, than furthermore to advance 'six nice performance's originate studies. Paper will discuss on mentioned problem and put forward a new point not only base on the practice of restore horn bow and shooting arrow throught more than ten years, but also base on investigate and compare the different text in Mengxi Bitan's various versions such as in AD 1146, in AD 1145, in AD 1631 and in AD 1906 so on.

Decipher; first-class bow has six nice performance; Mengxi Bitan

Geometry, Reality and the Astronomy without Hypotheses

Diego Pelegrin, Universidad de Buenos Aires

In September 1563 Petrus Ramus sent a letter to Georg Joachim Rheticus. In it he condemned all astronomical hypotheses for being contrary to the laws of logic, false and absurd; he assured that astronomy could subsist without any hypotheses; and he finally compelled Rheticus to free astronomy from the fictions of hypotheses. A few years later Ramus publicly repeated his condemnation of hypotheses and his claim for an astronomy without them. He also challenged european scholars offering a prize: he promised a regius professorship for anyone who succeeded in building an astronomy without hypotheses; he claimed he would be ready to leave his own professorship at Paris if necessary.

Ramus's claim for an astronomy without hypotheses achieved considerable notoriety among his colleagues. But Johannes Kepler was the only who claimed to have fulfilled Ramus' challenge. And

not one but two times! The first was in 1597 in a letter to Michael Maestlin in clear reference to his *Mysterium Cosmographicum*, recently published. The second time was in 1609 on the reverse of the title page of his *Astronomia Nova*.

The meaning of Ramus's astronomy without hypotheses is far from being clear. But Kepler's claims of having built it are frankly obscure, actually puzzling. Take the claim of 1597. How could Kepler's platonic solids model not be considered a hypothesis? The claim of 1609 is even more striking. Why would the author of two of the most important hypotheses in the history of science claim to have built an astronomy without hypotheses?

I suggest that a possible answer to these enigmatic questions is to be found in Kepler's distinction between geometrical and astronomical hypotheses. I also suggest that in the answer to these questions we'll find a master key to Kepler's epistemology.

History of Astronomy; Kepler; Astronomical Hypothesis; Geometrical Hypothesis; Astronomia Nova

The making of an eradication model: Hungary, Cuba, and the foundations of the global polio eradication program

Dora Vargha, University of Exeter

While the Global Polio Eradication Initiative (GPEI) is usually presented as the product of the 1980s and is seen as a philanthrocapitalist project, its roots lie in the socialist world of the early Cold War. Following extensive trials in Eastern Europe, in 1959, Hungary became the first country in the world to introduce the Sabin vaccine in its national vaccination program, shortly followed by the Soviet Union and Czechoslovakia. Two years later, with the help of Czechoslovak experts, Cuba began Sabin vaccination, becoming the first populous country in the Western Hemisphere to eliminate polio. By tracking the method of polio immunization with the Sabin vaccine as it travelled from Eastern Europe to Cuba the 1950s and early 1960s, this paper explores seemingly peripheral spaces in forming global health practices. Based on medical literature, personal correspondence and archival research, I argue that ideas about socialist health and socialist internationalism played key roles in global polio elimination and in laying the foundations for the GPEI. Vaccination methods developed in Eastern Europe and Cuba with the Sabin vaccine provided models in immunisation, on which the global polio eradication program was built on. Furthermore, the consistent Hungarian and Cuban immunization programs, in relatively unchanging health service systems under socialism, have been providing data on oral poliovaccine risks, which in turn inform global immunization strategies to this day.

polio, Hungary, Cuba, eradication, socialism

A Delicate Relationship: Apple Computer Inc. and the early Macintosh User Groups

Dov Lungu, York University

Shortly after the first Apple Macintosh was unveiled in January 1984, many of its early enthusiasts formed Macintosh User Groups (MUGs). By the end of the 1980s, these lively, mostly United States-based communities numbered in the hundreds. They comprised tens of thousands of people who often met on a weekly basis to learn about and explore the new technology. Their activities, not only those of Apple's developers, should be considered part of the broader history of the early Macintosh. This paper explores the intricate relationship between the MUGs and Apple Computer Inc. in the 1980s, emphasizing some of the incongruous perceptions of innovation that shaped that relationship. The MUGs saw themselves as mediating between Apple and both actual and potential users, by

functioning as open sources of information and mutual help. In addition, the MUGs had their own ideas on how the Mac could be improved and were keen to share those ideas with Apple in a way that today would be called open innovation. Moreover, in some instances – as I have discussed elsewhere – some of the MUGs engaged in direct user innovation. However, open innovation, let alone user innovation, ran afoul of Apple's closed and authoritarian innovation style. Apple was oblivious to the inventive spirit that characterized some of the user groups. Its corporate culture was dismissive of users' capacity to envisage innovation, still less engage in it. Even the usefulness of the user groups in their basic role as providers of technical help was at first undermined by Steve Jobs's largely erroneous belief that the early Mac would be as easy to use as a home appliance. It took Apple almost a year after the introduction of the Macintosh to grasp the central importance of the MUGs for its new computer's success.

Throughout the second half of the 1980s, despite closer collaboration between Apple and the MUGs, discrepancies persisted in how each of the two parties perceived their relationship. The MUGs continued to aim at a free flow of information about the corporation's present and future products, which would have enabled them to contribute not only to user support but also to the design and diffusion of the new technology. Yet, hampered by its penchant for secrecy and control, Apple came to regard the user groups only as a useful, albeit problematically undisciplined, addition to its marketing and support efforts.

User groups; Macintosh computer; User innovation; Open innovation; Apple Computer Inc.

New Reproductive Technologies and Women's Health in post colonial India

Aparajita Dhar, The University Of Burdwan

One arena of medical science in which there has been a phenomenal growth of technology is the discipline of obstetrics and gynaecology. The earlier history of this discipline is related to complicated births and the technology that evolved in this regard ranges from manual techniques to Caesarian section, forceps, and foetoscope to electronic foetal detector, amniocentesis, and intrauterine surgery that came with the science of embryology. By the middle of the twentieth century, it was not only decline in mortality rates or maternal mortality that remained the only concern, but also the desire of infertile couples to have children that became another area of research in the West. Gradually the technology came to several developing countries with strong patriarchal structures where motherhood and a male child continue to be strong social values. During the last few decades, this disposition of women has become a technological affair to ensure and achieve fertility. In this context, India has opened up its doors for profit-oriented global reproductive market in the form of Assisted Reproductive Technologies. They have institutionalized infertility as disease or epidemic and projected infertile women as patients who need to be cured. Much concern has been voiced from diverse quarters, ranging from feminist organizations to religious bodies, about the ethical, social and medical implications of ARTs. These include questions on the health and gender implications of the use of these technologies on female bodies, their effects on women's lives, and their importance for marriage, parenthood and childhood.

The Feminist International Network Of Resistance to Reproductive And Genetic Engineering [FINRRAGE] oppose these technologies on the ground that they exacerbate existing social inequalities. The FINRRAGE group has raised concerns about the potentially damaging consequences of these technologies for women. They also raise critical questions about who controls these technologies, thus making the point that so-called new choices do not necessarily spell progress. On the other hand feminist proponents of ARTs regard these technologies as bearing the potential to conquer reproduction, thus liberating women from their subordinate position.

reproduction, technologies, women, infertility, health

Nature Cures: Ethnic Therapeutic Knowledge of Some Ethnic Communities in India

Sutapa Sengupta, Kalyani University, West Bengal

The largest concentration of multiple ethnic communities can be found in the Indian subcontinent next to Africa only. From an extensive survey it has been found that more than 30 such ethnic communities dwell in the Chotanagpur plateau region from time immemorial. The latter entails a large part of modern Indian state of Jharkhand and some adjoining areas of Odisha, West Bengal, Bihar and Chattisgarh.

From the very beginning indigenous population is intricately connected to the surrounding nature which determines their economic and social activities, myths, religious practices even their medical knowledge. Their vast storage of ethnic therapeutic knowledge is empirical which has developed through their age old symbiotic relationship with nature and their first hand experience of the surrounding flora and fauna.

However from the mid 19th century these therapeutic practices and herbal medical knowledge are being constantly challenged. Devastation of natural forest as well as the artificial plantation of trees for commercial purposes posed a serious threat to their practice of using common medicinal plants collected from natural forest. Albeit the knowledge of ethno medicine in due course of time had faded away from prominent urban centres it did not totally get extinguished. Rather it continued to survive amidst the ethnic communities living in the remotest corners of the Chotanagpur plateau region, where modern medical facilities are not seriously available.

A survey reveals that, more than hundred plants are being regularly used due to their medicinal value. Some commonly found plants are Sal(*Shorea robusta*), Palash(*Buta monosparma*), Mahua(*Madhuka latifolia*), Mango (*Mangifera indica*) and others. Herbal remedies apart, the indigenous populace also take recourse to naturotherapy such as combination of mud and water therapy to achieve effective results. Indigenous people have discovered the miraculous healing power of water as well popularly known as hydro-therapy.

The discussion of ethno medicine remains incomplete without mentioning the use of magical chants related to treatment. To the ethnic communities at large medicine cannot cure any disease unless magically empowered by proper chants (mantras)

Lastly the healing power of ethno medicines is not entirely unknown to the common people of Bengal. Still there is a scope to retrieve hundreds of such forgotten ethnic remedies which will surely suffice the modern human civilization.

ethno- medicine, communities, herbal remedy, hydro-therapy, nature-cure

Fire, Pores, and Phlegm: Histories of Matter through the Lense of the Skin

Natalie Köhle, Australian National University

The rise of fire in Song period medicine entailed a momentous change in the experience of the body in the world, exemplified in the reconceptualization of fluids and qi, their movements out of and into the body, and the function of the body's invisible gateways, the pores. Chen Yan 陳言 (fl. 12th cent.) complemented classical fears of invasion by external pathogens with the menace of blocked pores, causing entrapment of heat, congestion of sweat, and its transformation into phlegm and turbid matter inside. Liu Wansu 劉完素 (fl. 12th cent.) speaks of myriad micro-openings, or subtle pores, that are the fabric of all creatures and parts of their bodies, even internal organs, claws, and teeth. These subtle pores, too, are in danger to be clogged by heat; they must remain open and in constant communication with their surroundings. The etiology of phlegm in pores and sweat is similar to that

in Greco-Roman medicine, while subtle pores are closely paralleled by the pre-Socratic philosopher Empedocles' (495-435 BC) atomistic conception of body structure. I argue that these parallels are not accidental; Chen Yan and Liu Wansu's reconceptualization of the interplay between openings and fluids illustrate a change in the conception of matter that took place over the Song period.

History of Medicine, China, Ancient Greece, Skin, Pores

Eclipses - Inscriptional and literary references, a survey

Padmaja Venugopal, SJB Institute of Technology

Eclipses had a significant impact on humans since ancient times. We find references to Solar eclipse in Rgveda which dates to BC centuries. The details and procedures of the concepts are discussed by the celebrated astronomer P.C.Sengupta. The Indian astronomical texts discuss about the phenomenon and computation of eclipses. As and when disagreement occurred between the observed and computed positions the great savants of Indian astronomy revised their parameters and if necessary the computational techniques, Astronomical tables served as an excellent tool for computational procedures of phenomena by almanac makers. Ganakananda is a popular text authored by Suryacharya that was popular among Andhra, Karnataka and most of the northern part of India. The text based on Suryasiddhanta method discusses the various procedures in a lucid way. It is a handbook containing both explanatory part and astronomical tables with the computations of heavenly bodies from mid noon. Inscriptional and literary references of eclipses are verified according to different texts. The reference of solar eclipse in Tandya Brahmana as also in Samyukta Nikaya are also discussed in the paper. Astronomical references quoted by Kalidasa of 562 A.D. is also explained.

Astronomy; Eclipses; Inscriptions; astronomical table; Ganakananda

Conjunction of Heavenly Bodies on stone inscriptions and Literary Sources

Rupa K., Global Academy of Technology

Conjunction of Heavenly Bodies on stone inscriptions and Literary Sources

When two celestial objects appear to be near in the sky, it is very attractive. This is true when one object covers another. Many of the ancient civilizations record these events in their literature. In India, we can find examples of astronomical phenomenon recorded or implied all the way from rock art to mantras in the Vedas describing certain astronomical phenomena, to computational astronomy described in the Siddhantas.

Stone inscriptions are of great importance to historians, sociologists and traditional scholars. In this paper an attempt is made to collect some details of occultations on stone and literary sources, work out the actual circumstances of the phenomenon and compare the results with modern software's.

In Indian astronomy, the siddhantic texts have discussed in detail the phenomenon of conjunctions of the Sun, the Moon and the planets, between any two of them as also with some important stars. Many conjunctions and occultations are recorded on the stone inscriptions may not have spelt explicitly.

In the famous text of Ptolemy's Almagest and Copernicus' De-Revolutionibus we get some interesting references to the occultation of some bright stars observed by the two great astronomers or their predecessors we provide some of these references and also others.

Astronomy; Conjunction; Occultation; Inscriptions; Siddhantas

Neurostimulation in the history of the exploration of human brain

Dupont Jean-Claude, Université de Picardie

DBS is an indication of neurological and psychiatric disorders. But besides its therapeutic use, it became also a tool for exploring the functioning of the basal ganglia. The technique is now located at the core of interactions between therapeutic practice and fundamental research. In this paper, we will present and discuss the contribution of DBS to the exploration of human brain.

Deep Brain Stimulation; therapeutic practices; neuroscience

Clodomiro Picado Twight (1887-1944): pénicilline, antivenins, conscience sociale et rôle de l'État

E. James Crombie, Université Sainte-Anne

Cette communication porte sur la vie et l'oeuvre de Clodomiro Picado Twight (1887-1944), scientifique, clinicien et acteur social – surtout en matière de santé publique. En plus de résumer la vie et l'oeuvre de cet important personnage, déclaré Benemérito de la Patria avant même son décès, on insistera sur le climat social et politique qui régnait dans son pays, le Costa Rica, au tournant du 19e et du 20e siècles. Ce climat s'est avéré particulièrement favorable – comme l'ont déjà signalé Gutiérrez et Monge (1989) – à l'essor de l'instruction publique ainsi qu'à l'avancement des sciences pures et appliquées – et a notamment permis à un jeune homme doué, mais d'origine relativement modeste, de faire un doctorat à Paris (avec une thèse sur les broméliacées épiphytes!) et ensuite de contribuer de manière importante à l'amélioration de la santé publique de son pays, notamment au chapitre de la lutte antiophidique par des recherches et des publications sur les serpents venimeux, par l'obtention et la production d'antivenins, ainsi que par sa promotion de la remarquable Ley de Defensa contra el ofidismo (promulguée par le gouvernement du Costa Rica en 1926). Cette dernière insistait notamment sur les obligations et les responsabilités de l'employeur de travailleurs agricoles risquant de rencontrer des serpents dans le contexte de leur travail. On reviendra enfin sur la question de savoir si Picado peut être considéré comme ayant devancé, dès 1927, la découverte de la pénicilline par Fleming, annoncée par celui-ci en 1929. (On se rappellera que cette découverte a valu à Alexander Fleming, ainsi qu'à Howard Florey et à Ernst Boris Chain, un Prix Nobel en 1945, soit en l'année qui a suivi le décès de Picado.) On constatera que les brevets et la propriété intellectuelle n'ont joué aucun rôle dans les accomplissements de Picado dans le domaine de la santé et de la santé publique. En conclusion, on cherchera à tirer de notre analyse quelques leçons sur le rôle que peuvent et doivent assumer les instances publiques et privées dans la promotion de la recherche scientifique et afin d'assurer l'accès universel et équitable aux fruits de celle-ci.

Clodomiro Picado Twight; public health policies; antivenoms; penicillin; promotion of scientific development

Medical benefits of minerals in Arab-Muslim Scientific Heritage and The relationship between Medicine and Geology

El ghalbi Khallaf, University Mohamed Premier

Minerals have been used by humans for the treatment of diseases since ancient times. Medical benefits have constituted one of the characteristics, adopted by Muslim scholars in the definition of minerals and their identification, as it is clearly seen in the majority of books that have studied minerals, and in many books on medicine and pharmacy, which focused on an inventory of single and compound drugs.

After examining a group of prominent heritage sources in mineralogy such as: "Ideas in recognition jewels" by Al-Bairouni, "flowers of ideas in jewelery stones" by Tifachi, it becomes clear that the medical benefits of the mentioned metals cover several medical specialties: ophthalmology, dentistry, Internal diseases, heart diseases, urinary medicine and kidney diseases, skin diseases, epidemiological medicine, cosmetic medicine, psychology, as well as the treatment of poisons, gout, and arthritis pain. and that these minerals have been used in different ways.

As for books on medicine and pharmacy, we limited ourselves to some extracts from two well-regarded medical sources, "The Canon of Medicine" by Ibn Sina, and "Al-Tasrif" by Zahrawi. We have highlighted from the book of Ibn Sina, a great diversity of metals used in the synthesis of drugs, the diversity of medical disciplines for which these drugs were prescribed to treat, and the multiplicity of medication forms prescribed: ointments, bandages, tablets or capsules, drops, eyeliners and injections...

We have also stressed from the book Zahrawi that many of the mineral ingredients of drugs prescribed for the treatment of mouth and teeth diseases are still used in modern medications in dentistry namely vitriol, borax, salt, and especially alum.

Then we drew attention to a part of the attitudes of contemporary literature to the history of the development of metal medical applications in what concerns the presence of the subject in Arab-Muslim scientific heritage, through what Maria Barroso has written about the use of Bezoars, and what was written by Jean-José Boutarik on medical applications of magnets.

In conclusion, we pointed out that the awareness of health problems of metals has been present in metal and medical Arab-Muslim Scientific heritage from the beginning.

It is important to underline that metals health benefits and concerns form the two parts of medical geology, which represent an emergent and promising field of Earth Sciences in recent times.

Mineralogy; Medecine; Arab-Muslim; Heritage

Bodily Glands and Narrative Agency: Metabolic Storytelling in early Soviet Russia

Elena Fratto, Princeton University

In the wake of fin-de-siècle discoveries in the field of endocrinology, bodily glands, alongside the hormones they produce, featured prominently in the literature, visual arts, and popular culture of early twentieth-century Europe. Experimental surgery, with gland transplantation and grafting, promised rejuvenation and vitality, while phenomena of all sorts began to be associated to hormone production in causal links--from bodily rhythms to behavioral patterns, from the pace of history to the trajectory of nations. In early Soviet Russia the increased interest in hormones went hand in hand with the experiments in eugenics. This paper analyses Mikhail Bulgakov's "Heart of a Dog" through the lenses of thing theory, posthuman studies, and narrative studies, and it shows how the activity of the pituitary gland does not only affect bodily functions, but it also dictates narrative time and raises questions of agency.

History of medicine, narrative agency, narrative time, Bulgakov, metabolism

Human Ecology and the Development of New Theories of Cultural and Biological Evolution

Emilie J. Raymer, Johns Hopkins University

In the 1940s and 1950s social scientists harnessed ecological theories to construct new models of biological and cultural evolution. Among these, anthropologist Julian Steward, cultural geographer Carl Sauer, and historian James Malin developed a field of study called “human ecology” which investigated how biotic and cultural evolution were intertwined and symbiotic. These investigations influenced environmental and social policies and ushered in new ways of thinking about—and studying—humans’ effects upon the natural world.

This paper will argue that human ecology was significant for two reasons. First, it facilitated interdisciplinary collaboration surrounding the issue of humans’ effect on the natural world. This discourse elucidates the intellectual origins of the concept of the Anthropocene. Steward, Sauer, and Malin contended not only that social scientists needed to study the biological sciences in order to understand how environment shaped human culture, but also that scientists needed to incorporate the effects of human activity into their investigations. Inspired by this approach, ecologists Charles Adams, Hugh Raup, and others integrated human activity into their research and encouraged fellow scientists to do the same. One of the first serious multidisciplinary efforts to study the effects of human activity upon the natural world, this paved the way for future investigations about Anthropogenic climatic, geologic, and ecological change.

Second, theories of biological and cultural evolution that Steward, Sauer, and Malin composed were significant because they deconstructed binaries of “savage” and “civilized” implicit in previous models of cultural change and led to new ways of conceptualizing indigenous cultures in the United States and South America. Rather than conceptualizing cultural evolution in a hierarchical and unilineal manner, they argued that the region humans inhabited influenced their cultural evolution. These regionally-specific theories of evolution applied local knowledge to more global, universal theories of biotic and cultural change. Their evolutionary theories were also important because they argued that agricultural activities of indigenous cultures, like those of white settlers, had had a calamitous effect on the natural world—thus implying that indigenous and Anglo-Saxon peoples were more alike than they were different from an evolutionary and environmental perspective.

evolution, ecology, social sciences, Anthropocene, geography

From Rio de Janeiro to London: Longitude and the Shaping of the South Atlantic

Eoin Phillips, Universitat Autònoma de Barcelona

Juan Ignacio Neves Sarriegui, New College, University of Oxford

By the opening decades of the nineteenth century, the British Board of Longitude - a state body in charge of promoting the development of ways of measuring longitude at sea - had invested a great deal of time and money in testing and attempting to deploy and manage a series of new and complicated hardware and astronomical techniques, in order to transform the nautical practices of the Royal Navy. While the traditional interpretation of the quest for longitude focused on the relation between ingenious and individual artisans - John Harrison - and heroic users - James Cook, more recent work has emphasised the need to understand the development of techniques for finding longitude in the context of the shift of British imperial and maritime expansion from the Atlantic to the Pacific and Indian oceans. However, in these analyses, the importance and changing character of the South Atlantic has generally been overlooked.

Through an examination of the letters and publications by the Portuguese astronomer José Victorino dos Santos (?-1852), this talk will aim to explore the important role that British maritime expansion had in the shaping of Rio de Janeiro as a crucial maritime port. By following the interactions between the Board of Longitude, Portuguese/Brazilian astronomers and officers of the British Navy and Packet Service, this talk will aim to show the ways in which the attempt to find longitude at sea was not simply a maritime – or ‘wet’ concern- but was also a significant – ‘dry’ concern – in the shaping of maritime cities. In so doing, the talk will also aim to highlight the important ways in which the story of longitude should not assume Britain as a the most central port, but instead question the nature of the changing and entangled relations between several maritime states.

Longitude; Astronomy; Rio de Janeiro; Royal Navy; Observatories

Moving people, moving knowledge: African slaves and medical practices in 18th century Estado da Índia

Eugénia Rodrigues, Centro de História da Universidade de Lisboa

In recent years, scholars have focused on the non-European world, and mainly the imperial territories, as spaces of production of knowledge in themselves and not only as a repository or an object of European science. These investigations have uncovered the importance of the local agency on the margins of the European empires, as well as the processes of negotiation in the circulation of knowledge. In the case of the Indian Ocean, the old relations that connected its shores were reconfigured in the early modern period by the emergence of new imperial powers, mostly the European ones, establishing new networks by which people, products, ideas and knowledge circulated. With regard to the Portuguese empire of the East, the State of India (Estado da Índia), the medical knowledge, carried by multiple actors, circulated among several territories. This paper intends to analyze the role of Africans in the transfer of therapeutic knowledge from Mozambique to Goa. Available sources indicate that African slaves in India used African therapies to treat patients, probably a specialization they already had in Africa. In this process, Africans also assumed the role of reluctant intermediaries and translators of African therapeutic knowledge for Indians and Europeans. Nevertheless, not much focus has been paid on how African individuals participated in the process of building knowledge in India.

"knowledge circulation"; "African medicine"; "Portuguese empire"; "Indian Ocean"

Francisco Bolonha Palacete: Technology Transference In Belém of Pará, Brazil

Euler Santos Arruda, UFPA, Brazil
Cybelle Salvador Miranda, UFPA, Brazil
Maria Paula Diogo, FCT/UNL, Portugal

We aim the eclectic building of the civil engineer Francisco Bolonha and that was his home and his wife, the pianist Alice Tem-Brink (whom he married in Rio de Janeiro) and after, returned to live in Belém, the house of his Father Colonel Francisco de Paula Bolonha and Mrs. Henriette Adelaide Rodrigues Bolonha. This residence, located on the corner of Nazareth road to Assis of Vasconcelos street (where worked the School Group Floriano Peixoto and is currently "Casa da Linguagem"). It is important to report that Francisco Bolonha was born in Belem, on October 22, 1872, in house of his parents. Bologna lived from 1872 to 1938 and their marriage children were not generated. Designed and built in Belém, several buildings of eclectic modinatura gathering styles Neoclassical, Art Nouveau,

Baroque and Rococo influenced by his return from Europe in end of the nineteenth century where he completed his engineering studies, introducing new construction techniques and materials, harmonic use: metal structures, glass, tiles, tablets, stuccoes, Ploié screens, roofing slate, bricks, glass and reinforced concrete. It should be noted that it was one of the founders of the Pará Engineering School. Given the importance of the Palace Bolonha was registered on 07.02.1982 by the Department of Heritage, Artistic and Cultural Pará State Government. The objective of this work is to verify the transfer of technology that its designer and cosntrutor providing technological assets acquired in Europe started and developed the construction of his mansion in the period from 1905 to 1908. With the lifting bibliographical sources and documentation to identify remaining technical data and then available technology used in a social context of the time. It is hoped the discovery of new elements of its trajectory.

Bolonha Palacete; Technology Transference; Belém of Pará (Brazil)

Reflections from Mexico: clinical attention of intersex children in a context of extreme inequality

Eva Alcántara Zavala, Universidad Autónoma Metropolitana, Xochimilco

Clinical attention of intersex children in Mexico depends on economical and social situation of the family where a baby was born. The problem of inequality is increasingly important worldwide and Mexico is a good example of that. In my country, there are a few multimillionaires that have captured excessive privileges and coexist with fifty million of people that are considered in poverty. This work is part of ten years of research whose central question is to explore how intersex condition is developing in Mexico. I followed the ethnographic method, which included one year in which I was working as a member of the health team in intersex's clinic, interviews with patients and ex patients, interviews with patients' relatives and medical team, as well as historical and documental research. In the last three years I had been in closely contact with the emergent intersex community in Mexico. Medical protocols related to intersex conditions have a global impact, although its local practices are variable. Mexico's Health System offers different levels of care to different groups and at different prices. The aim of this presentation is to analyse three cases of CAH with different access to Health System in which socio economical situation shaped the interpretation, treatment and life quality. Differences in life opportunities disrupt factors such as the age at which the diagnosis is made and health status related to syndrome's repercussions. On the other hand, for CAH people not always an early contact with Health System has the best long time outcomes in all life aspects. The possibility to grow up without medical attention protects the physical integrity of CAH children, especially of unnecessary surgical procedures to make the appearance conform to binary sex stereotypes. In hospitals 46,xx children with CAH tends to be raised or sex reassigned as girls; however, when there were born with genitals that looked male and they did not have access to Health System some of them grow up as male and have a better life related to gender aspects. Even children with CAH who were assigned girls at birth and "virilised" may be able to find how to enjoy their bodily differences even in their sexual practice.

Inter sexuality; poverty; inequality; medical treatment; CAH

Renovação Médica: Political Conflicts, Bioethical Controversies, and the Brazilian Medical Sector, 1974-1985

Eyal Weinberg, The University of Texas at Austin

This paper explores the political shift that swept the medical sector in Brazil toward the end of the military rule, from the late 1970s to early 1980s. The coup d'état of 1964 fractured the Brazilian medical community. While security forces quelled protests by medical students and detained activist doctors, conservative physicians took control of medical associations and advanced policies that encouraged the growth of private healthcare businesses. The intensification of violence after 1968 amplified the sector's polarization as medical professionals prone to disregard the Hippocratic Oath played an essential role in state-sponsored repression. They falsified medical reports to conceal evidence of extralegal executions and monitored victims to enable prolonged torture sessions. The paper focuses on a group of young physicians who mobilized in the late 1970s to transform and unify the divided medical sector. It follows the rise of the Movement for Medical Renewal (Movimento Renovação Médica-REME), an inclusive body of progressive doctors who sought to remove the old guard that controlled the sector and push for democratic reforms within its regulatory bodies. After taking over Rio de Janeiro and São Paulo's Doctor Unions (1977/8), REME's campaign spread across the country, winning elections in various professional associations and medical councils. In tracing its rise, I explore how REME supported the mobilization of doctors demanding better pay and working conditions, called for the reorganization of the national healthcare system, and reevaluated the profession's ethical code. Finally, the paper examines REME's repudiation of the regime's use of violence, analyzing the efforts of regional medical councils to investigate more than one hundred physicians allegedly involved in state repression. Relying on state records, intelligence reports, and archives of medical associations, the paper demonstrates not only how political controversies and professional disputes played a key role in the history of the medical sector under military Brazil, but also how bioethical questions framed a critical component in the community's struggle for transitional justice.

Brazil; repression; bioethics; military regime; history of medicine

Techniques of the self and experimental introspection in 19th Century: a possible field of historiographical studies

Fabiano dos Santos Castro, Centro Universitário Celso Lisboa
Arthur Arruda Leal Ferreira, Federal University of Rio de Janeiro

Considering the objective of this work, we begin the text with a discussion of the concept of technologies of the self developed by Michel Foucault in the 1980s. From this initial standpoint we will work with this concept from the perspective of the categories of substance, askesis, modes of restraint and teleology. However, our main interest lies in emphasizing Foucault's usage of Christian ethics to explain the emergence of psychological knowledge and practices, in the invention of a new ethical substance (our desires) and a new askesis (the hermeneutics of the self). Nonetheless, the objective of this approach is not in producing a general presentation of the concept of techniques of the self or a historiographical and genealogical discussion of psychology. Rather more modestly, it seeks to evaluate the presence of techniques of the self where they are unexpected: in experimental practices where the observers transform themselves into a scientific instrument through specific training. This lies between the scientific method and spirituality, adopting possible relationships between the production of the self and the production of a true discourse. What specific type of askesis is generated by these laboratory techniques? With this question we will approach those rare descriptions of introspective practices and their training methods in Psychology and Fisiology

laboratories in the end of 19th Century / the beginning 20th Century to see if they are techniques of the self, how these techniques are structured and what singularities they present in comparison to current psychological methods. In this presentation we will work with material from different sources, such as the writings of Helmholtz, Wundt, and Titchener. A closer examination shows differences in the concept of introspection between these authors. Generally speaking, Helmholtz presents the need for training in order to conduct subjective observations, which differ from common observations. Wundt establishes the difficulty of psychological observations (which are always altered by the act of observing), opening the way for psychological experiments where the stimulating conditions can be controlled. Titchener emphasizes in a more precise manner the general and special rules of psychological observation. Finally we will establish a discussion of the political meaning of these changes, inviting a dialogue with Bruno Latour's Actor-Network Theory and Vinciane Despret's Political Epistemology.

Experimental Introspection; Techniques of the self; Psychology; subjectivation process

A Reexporation of the improvement of tea-making technique during the end of Qing Dynasty and the Republic of China

Fan Huichuan, University of Science and Technology of China

Affected by the competition of the emerging tea-producing countries, in the end of 19th century, the leading position of China tea went way down from peak to trough in the international market. Under this circumstance, from ordinary merchants to court officials, all the far-sighted personages in China advocated and appealed for the improvement of tea industry. Most of them had got to know the development of the modern tea industry of India, Ceylon, Java, and Japan directly or indirectly. Through contrastive analysis, they put forward the thought of improvement, involving almost all the aspects of the industrial chain such as tea cultivation, tea garden management, the introduction of tea machinery, as well as company management, advertisement expenditure, talent cultivation, reform of taxes, and so on. After all those attempts and efforts over years, the improvement of China tea industry obtained a success in some aspects, which also to some extent helped establish a good foundation for the modernization of China tea industry. However, in the end of the Republic of China, the industry still had not changed substantially and got stuck in the passive dilemma out of the tough competition. The failure of the revival project on China tea industry resulted directly from the imbalance between the tea-making technology and operating capability and fundamentally from the production mode of the traditional natural economy's failure to rival that of the capitalistic economy.

technique improvement; tea industry revival ; China tea; India tea; Ceylon tea

An early modern illustrated herbal translated into Portuguese: João Vigier's "Historia das plantas"

Fernando J. Luna, Universidade Estadual do Norte Fluminense

For this presentation, the centuries-long trajectory of some of the knowledge about plants from Dioscorides's pharmacopoeia was followed as it took the form of various printed editions, translations, expansions, modifications and compilations, beginning with a sixteenth century latin edition until it reached the Portuguese language, in the early seventeen hundreds. The book entitled "Historia das Plantas e das mais uzadas que vem de Asia, de Affrica, & da America", an illustrated herbal, was published in Lyon for Jean (or João) Vigier (1662-1723), a French apothecary

and drug merchant based in Lisbon, as part of the retinue of the French-born queen of Portugal. The two volumes of Vigier's edition, printed in duodecimo in 1718, give the description of about 800 plants, most of which are accompanied by a woodcut depiction, according to the format discussed and well explained in the book's introduction. Each description, which takes one or, in some cases, two pages, contains the name of the plant according to the Swiss botanist Gaspar Bauhin (1560-1624), as well that according to the Italian physician Pierandrea Mattioli's (1501-77) nomenclature. The figures depicting the plants take up the right side of the page, while on the left one finds the names by which the plants were known in Latin, Portuguese, French, Spanish and German. Additionally, under the heading 'qualities', the plant is classified as being hot, cold, dry or moist, according to the humour theory.

Some aspects of Vigier's work as a translator and author will be discussed under the light of recent transdisciplinary scholarship in the intersection of the history of science and the history of the book. The genealogy of Vigier's oeuvre can be traced directly to Mattioli's "Comentarii a Dioscoride" (1544 and 1554), which went through multiple editions, modifications and versions made by different men, mostly in France and Italy on the course of almost two centuries, before being translated into Portuguese and made available for physicians, students and travellers in the vast Lisbon-based Empire. This case study opens a window to show how knowledge about medicine and pharmacy was available in Portuguese in the Modern period, addressing its origin, uses, depiction, discussion and intended audiences using a pocket-size, illustrated herbal book as an exemplar.

herbals; materia medica; botanical illustration

The Portuguese Inquisition and the Censorship of Scientific Books in the Sixteenth Century

Francisco Malta Romeiras, Centro Interuniversitário de História das Ciências e da Tecnologia, Universidade de Lisboa

The publication, reading, circulation and censorship of scientific books in the sixteenth and seventeenth century has proven to be a topic of intense research in the past few years. For what concerns the censorship of scientific books and authors, most accounts focus on the role played by the Spanish and Roman Inquisitions. Moving apart from recurrent individual cases, and following a broad view of science, the 'scientists' whose works were prohibited, censored or investigated in Spain and in Rome, have been identified and extensively studied in the past few years, namely by José Pardo Tomás, Ugo Baldini and Leen Spruit. Unlike the Roman and Spanish cases, the role played by the Portuguese Inquisition in the censorship of scientific books and authors has been largely neglected both in the historiography of science and in the historiography of the Portuguese Inquisition. During the sixteenth and seventeenth centuries, the Portuguese Inquisition issued eight Indexes of Forbidden Books (1547, manuscript; 1551; 1559; 1561; 1564; 1581; 1597; 1624), and the sixteenth-century Indexes have been reproduced in various critical editions, namely by Israel Salvator Révah (1960), José Sebastião da Silva Dias (1963), Artur Moreira de Sá (1983) and Jesús Martínez Bujanda (1995). Nevertheless, the scientific works and authors expressly condemned in Portugal, apart from some renowned individual cases, have been overlooked. In this communication, I expect to shed some light into the functioning of the Portuguese Inquisition in what concerned the censorship of scientific books, namely by analysing the inclusion of twenty-one books and authors specifically condemned in the Portuguese sixteenth-century Indexes.

Inquisition; Censorship; Scientific books; Portugal

The epistemological history of the stimulus-response immunology model versus a cognitive immunology of Francisco Varela and Nelson Vaz

Francisco Xavier Caprario, UFSC

Since Edward Jenner and the development of smallpox vaccination in the eighteenth century until the Clonal Theory of twentieth century, immunology has developed under clinical epistemology, basing itself on the "paradigm of estrangement" is called by Nelson Vaz, in which the organism Recognizes antigens Or foreign materials that trigger complex mechanisms of elimination of the organism, thus taking the result processes.

Immunology has been accumulating more and more evidence that it is eroding its fragile structure as the presence of activated auto-reactive lymphocytes in healthy individuals or the phenomenon of oral tolerance (the ability to become easily tolerant to immunogenic proteins in contact with mucous membranes in individuals adults)

The wear and tear of the stimulus-response model, which ultimately comes as a result of the complex self / nonself recognition mechanism, results in a black box that does not answer questions. It is in this conceptual crisis that an alternative point of view arises through a systemic epistemology. Niels K. Jerne (1974) proposes an original theory about immunology, based on the existence of antibodies capable of recognizing antigenic (idiotypic) determinants in antibodies formed by the same organism. In this way, when an antibody is formed, the body responds by forming anti-antibodies. Jerne went on to call it "Network Theory", in which immune reactivity becomes secondary, because the network is turned to itself.

Thus, Nelson Vaz uses autopoiesis to join the "Network Theory" and its observation by experiments, that there is the capacity of transference of tolerance to a certain substance through the introduction of lymphocytes previously induced to tolerance. Francisco Varela and Nelson Vaz publish *Self and Nonsense* demonstrating that the immunological reactivity centered in the organism. The immune system, observing these conditions, forms a systemic behavior of "cognition" in the autopiético sense. For this reason, Nelson Vaz calls the paradigm of autodetermination or immunological autopoiesis.

For Nelson Vaz, the central paradigm of immunology can only be overcome through a conceptual movement that is independent and therefore epistemological.

Jerne Nk. Towards a network theory of the immune system. *Ann Immunol (Paris)*, 1974; 125C (1-2): 373-89.

Vaz N M. Francisco Varela and the Immunological Self, 2011; 28: 696-703 *Systems Research and Behavioral Science*.

Systemic epistemology; autopoiesis; Francisco Varela; Nelson Vaz; Immunology

Collecting Minerals at the Royal Institution in the early nineteenth century

Frank James, Royal Institution / University College London

The Royal Institution in London was founded in 1799 for the purpose of providing scientific lectures to its members. This function continued when Humphry Davy (1778–1829) was appointed there in 1801 originally as lecturer in chemistry, but soon promoted to professor. His universally acknowledged brilliance as a lecturer put him in a very powerful position to develop his own agenda for the institution. As is well known he added scientific research to the aims of the Royal Institution, something that had never been intended or envisaged by its founders. What is less well known, and has hardly been studied, is that from 1803 Davy began to establish a collection of minerals. In the ensuing years and funded by the Royal Institution he toured the British Isles for months on end ultimately collecting several thousand mineral specimens which were displayed in a large room in the Institution. The avowed public purpose of this collection was to provide information on the mineral

resources of the islands with the intention of extending that knowledge to the Empire. It would then be possible, ran the argument, to exploit economically these resources for industrial use, something that was especially significant during the war against France. Thus, the very local context of an institutional mineral collection was potentially given global significance by its potential use. Furthermore, this episode illustrates the attitudes espoused by Davy and the Royal Institution about the potential power of science and its value to increasing the wealth of society. But Davy was also heavily interested in mineralogy and geology (a surprisingly understudied part of his career especially as his notebooks are full of information on minerals, volcanoes and other geological phenomena). So, it is possible that Davy used the rhetoric of the power of science for his own purposes.

Royal Institution; Humphry Davy; Mineralogy; Collecting

Scientific pluralism in the Physical Sciences and its relativistic implications: a Deweyan philosophical perspective

Frederik Moreira dos Santos, Universidade Federal do Recôncavo da Bahia

In this essay, we discuss certain aspects of the relationship between scientific practice, metaphysical beliefs, and theoretical interpretations. Our position is a form of naturalism that is sensitive to pluralist scientific interpretations. We argue that it is possible to be methodologically pluralist and relativist in scientific practice, without being a global relativist that follows the anarchist aphorism “anything goes”. Our investigation seeks to make explicit a naturalistic humanism which is not committed to any specific ontology or to any specific methodological strategy. The existence of several interpretations in the Foundations of Quantum Mechanics gives us a nice example of how this pluralism works in Physics. There are also other examples in theoretical physics, when results from different and incompatible theories in contemporary physics are used, such as the use, in particle physics, of both relativistic equations and the Heisenberg uncertainty relations in the kinematic analysis of subparticles. This pluralist picture is drawn from a pragmatic perspective concerning the nature of scientific investigation, and we will approach the concepts of Nature and experience according to the views of John Dewey. Dewey made explicit some general patterns of inquiry which connected several kinds of methodological positions in the history of knowledge. According to him, truth and theoretical progress are guided by the solutions proposed by members of the scientific community immersed in a historically located tradition of investigation. From such a Deweyan perspective, we analyze scientific pluralism, the possibility of relativism, and the autonomy of natural science. By bringing together historical studies and philosophy of science, we argue for the preservation of a certain kind of objectivity (of experience) in scientific practice, despite of its plurality. Moreover, we explain why physics can be considered a unified discipline in spite of its different methodologies, philosophical foundations and cognitive values. We close by discussing what sort of metaphysics and explanations are acceptable in our naturalist approach.

Scientific Pluralism; Relativism; Pragmatism; History of Physics, Naturalism

Participating in Victorian Natural History through the Illustrated Periodical

Geoffrey Belknap, University of Leicester

The practice of illustrating Victorian natural history periodicals was widespread throughout the century. Yet the value, meaning and intent of these illustrations as objects of scientific evidence within an essential site of scientific communication is little understood. Focusing on the genre of the

natural history journal between 1840-1890, this talk will evaluate the role of illustrations in offering an access point for the amateur naturalists to participate within the knowledge community of the Victorian periodical. A key aspect in this analysis will be to differentiate between authors and readers of competing periodicals in order to evaluate whether there is an overlap between contributors and consumers of the Victorian periodical. In this way, this paper will pay particular attention to the category of the non-professional author and illustrator in order to better understand the role of the periodical in giving access to a wide audience to the sites of production and reproduction of nineteenth-century natural history. Highlighting the website www.sciencegossip.org, the paper will also draw parallels between the historical practice of uncovering participants in Victorian natural history through the periodical with the modern practice of utilizing digital humanities tools – particularly citizen science/humanities – to generate and forward historical research.

Natural History; Visual Culture; 19th Century; Citizen Science; Digital Humanities

Science for the Biosphere and the emergence of global ecology

Giulia Rispoli, Max Planck Institute for the History of Science

Aiming at contributing to the recent debate on the Anthropocene – the geological era in which humanity has become the most powerful force on the Earth (2000) – this paper focuses on scientific international collaboration developed in the second half of the 20th century with the aim promoting interdisciplinary research on the biosphere as a global system.

Since the 1960s, scientific collaboration among scientists from the Eastern and the Western world worked on mathematical modeling of biosphere processes to simulate the effects of human activities on ecosystems and investigate the co-evolution between human society and the biosphere. In this regard, the work undertaken by Soviet mathematician Nikita Moiseev and ecologist Yuri M. Svirezhev with American and European colleagues Bernard C. Patten and Sven Jorgensen is worth exploring, and so is the involvement of Svirezhev in the first Soviet-American agreement for the protection of the natural environment during a meeting held at NASA in 1972.

The international team worked on large-scale projects of ecosystems dynamic that were supported by the Scientific Committee on Problems of the Environment (SCOPE) and extended their collaboration over biosphere models and sustainability research.

The "Moscow biosphere modelers" were even more ambitious: they promoted a new global research program intended to offer strategies for the governance of the whole society. Results obtained could be used not only to monitor biospheric processes but also to produce alternatives in the future development of society, new policies and progresses in science and technology (1985).

This paper examines international efforts underlying the establishment of global ecology – the scientific discipline that investigates humanity as an agent in the transformation of the planet – and shows how science was used to encourage international cooperation (notwithstanding the tense time of the Cold War) and foster a global awareness of man's impact over the earth-system, which will be fundamental to the rise of the Anthropocene theory.

Biosphere models, global ecology, science diplomacy, Soviet Union, Anthropocene

Nutrition Research Carried out in the Southwest China during WWII

Gong Wang, Tsinghua University

Jian Yang, Tsinghua University

As we talking the research of world history of science, a question draw our attention is how scientists take part in the war by doing scientific research, but the situation in China has not been fully studied. What kinds of work did Chinese scientists engage in during war time? How did they contribute to win the war? And how did they contribute to the development of science? My research will take Nutrition science as an example to discuss the Chinese scientific activities in World War II. The Nutritional research is very important to the protracted war, such as the Anti-Japanese war of China. Wan Xin, Zheng Ji, Wang Cheng-fa and Shen Tong; they are the first generation nutritional scientists of china. During the war, they had done some studies of the nutrition survey and improvement both at the battlefield's front and the rear. Through their studies, some plans were figured out to help the urgent needs of the Anti-Fascist War. At the same time, several papers were published in famous journals. Western nutritionists believed these papers made up the field of the basic standard in human nutrition which were ignored by western world. In addition, the cooperation made by the Scientific Community of Anti-Fascist between China and the western was also mentioned all the time during the WWII.

World War II; Scientist; Nutritional Science; Nutrition Survey of Battlefield; International Scientific Cooperation

Between reason and faith: a tried to refuse the darwinism in the late 19th century in Colombia

Gonzalo Peñaloza, Universidad Distrital Francisco José de Caldas

Jairo Robles-Piñeros, Universidad Federal de Bahía

To the end of the nineteenth century, Darwinism had become in a revolutionary though into the academic and social world of western, after the publication of *On the origin of species*, it was a innumerable works around the world caring off to put their points of view towards the Darwinian postulates about his theory of biological evolution by natural selection, whether it was to support him or to oppose as occurs most time; Colombia wasn't the exception and during its process of conservator political restructuration in finals of the century, founds in Darwinian thought a resistance focus to its philosophical and ideological projects, resulting in an unflagging struggle for refute Darwin's ideas. So it proposed to analyze the work called "Estudio sobre el sistema evolucionista" (1891) written by Emilio Cuervo, at the light of his philosophical and rhetorical arguments, searching to evidence and analyze the impact that the Darwinism had in Colombia in the end of 19th century, not only in the intellectual level but also into the political and social spheres in the country.

Creationism; Darwinism; evolutionism, history of Biology; natural theology; Neo-thomism

“The Imperfections of the Geological Record”: Geology Periodicals in the Nineteenth-Century

Gowan Dawson, University of Leicester

Periodicals were, from the seventeenth century, the chief means by which discoveries and claims to new knowledge were communicated and validated in many scientific areas, and historians have long recognized that the publishing practices in a particular field had important implications for their development and direction. The Geological Society of London's (GSL) official "Transactions" were the most prestigious and authoritative site for publishing geological research in early 19th-century Britain, and helped establish the direction of the still fledgling science. However, the GSL's elitism and centralization of intellectual authority prompted the publication of a number of self-consciously independent rivals, which defined themselves against the publishing practices of the GSL and recruited overtly popular readerships. These commercial journals, as this paper will argue, took the science of geology in new directions from those dictated by the GSL, and eventually became more significant than the GSL's official publications. While the GSL's initial emphasis on observation and fact-gathering ensured that geology became popular as an amateur past time with ordinary men and women, their interests and aptitudes, particularly in local studies, were not catered for in the GSL's periodicals. Amongst the cheaper, commercial journals that initially stepped in to fill this gap in the market, the "Geological Magazine" soon took a more professional direction, and, by the end of the nineteenth century, had become the leading periodical in the field, with the nascent Geological Society of America seeking an official affiliation with it rather than the GSL's "Quarterly Journal". As a commercial journal needing to turn a profit, the "Geological Magazine", although principally catering to the needs of the emergent community of professional geologists, continued several of its innovative approaches for maintaining circulation and eliciting popular interest in geology into the late 19th century, taking geological research in new directions very different to those countenanced by the GSL. This paper will explore the tensions between official society publications and independent commercial journals, which, while common across many sciences in the nineteenth century, were more pronounced and consequential in geology than in any other area.

geology; journals; nineteenth-century Britain

The history of chemistry in Pará: The trajectory study started by the creation of the pharmacy school (1904-1921)

Gysele Maria Morais Costa, Universidade do Estado do Pará
Maria Dulcimar de Brito Silva, Universidade do Estado do Pará
André Silva dos Reis, Centro de Ciências e Planetário do Pará

This research aimed to recover the origins of the Teaching Chemistry in Pará in order to create new sources of research in this field, contributing to the studies in History of Chemistry in Pará from the creation of the Pharmacy School. The beginning of the 20th century was still marked by the conflict of folk medicine and modern medicine. This fact culminated, during the First Republic, in policies concerned with life's quality and scientific interests. The creation proposal to Pará's Pharmacy School rose with the spread of the Pará's Medical-Pharmaceutical Association, conceived in 1897 by the Governor José Paes de Carvalho to the state's progress, to deal with social, scientific and moral issues with aspiration to provide public health services (NASCIMENTO, 2015). The main goal in the school creation project was to defeat diseases that ravaged the Amazon and the legitimacy of the School Degree. The Pharmacy School was created in 1904 in Belém do Pará working in the library of the State Sanitary Service. The high school course was composed by three teachers from the health institution itself and the course was completed in two years. The subjects related to teaching chemistry in the

first and second year were: Medical Chemistry and Pharmacology (practical and chemical pharmacy). (SILVA, 2003). After six working months, the establishment was equated with the official schools in Brazil, needing to be reorganized according to the Organic Law of Higher and Basic Education. This law determined the exercise of regulated professions, certified the school degrees and full freedom in the didactic and administrative point of view. With this, the course duration changes to three years. In chemistry's spot were taught: Mineral Chemistry in the first year; Organic and Analytical Chemistry in the second year; and Industrial, Toxicological, Bromatological Chemistry and Pharmacology in the third year. In order to set up the perfect regularity of the course, some other adaptations were necessary, such as a federal inspector at school, taxes to emit degrees and a new way of teaching in 1921. In this time, the subjects were divided in six sessions, which the second and fifth sessions were occupied by chemistry, being; Mineral, Organic and Industrial Chemistry in the second and Analytical chemistry in the fifth session (SILVA, 2003). Thus, the Teaching Chemistry in Pará's Pharmacy School added to the History of Science research.

History of Chemistry; School of Pharmacy; Chemistry teaching"

Celebrating Linnaeus: The Royal Swedish Academy of Sciences and the Modes of Commemoration at the Centennials of Carl Linnaeus' birth in 1807, 1907 and 2007

Henrik Björck, University of Gothenburg

Carl Linnaeus was born in 1707 as the first child of a country priest, in the rural province of Småland in southern Sweden. In 1778, he died as Carl von Linné and professor of medicine at Uppsala University, close to the capital Stockholm, ennobled by the king and acclaimed in the world of scholars as botanist and "the father of taxonomy". In 1739, after having returned to Sweden from a three-year stay abroad, he became one of the six founders of the Royal Swedish Academy of Sciences. He was the Academy's first president and became its internationally most renowned fellow. In this presentation, I will explore the forms in which the Academy of Sciences and other actors have handled and celebrated the memory of Linnaeus at the centennials of his birth in 1807, 1907 and 2007. What images has the Academy made and conveyed of its famous founding father, how has the memory changed with the institution and its position in different times? By focusing on a very specific detail, which in a formal sense can be held constant over a long time-period, it is possible get a special vantage point for a historical comparison. The comparative perspective vividly illustrates how the specific object of study, in another sense, has undergone almost revolutionary transformations. The Royal Academy as institution and the image of science in society have changed, as have the practices of commemorating famous scientists and the modes of conveying images of them to the public sphere.

In 1807, the Academy had no plans to celebrate Linnaeus. Instead, initiative came from a former disciple, an influential physician from Småland, who organized a celebration there to honor the local genius. He also managed to engage the king, who ordered the Academy and Uppsala University to buy copies of a bust made for the occasion. Things were different in 1907, when Linnaeus had become a national concern, a symbol that both united the people and upheld Sweden's honor in the struggle with other nations of culture and science. But there was also a struggle between Småland, the Academy and Uppsala University who was the right caretaker of Linnaeus' legacy. A hundred years later, the fabrication of this cultural heritage went truly viral. An elaborate organization for the centennial grew under the roof of the Academy. It channeled enormous amounts of money and coordinated projects on a global scale. Many actors wanted a piece of the Linnaeus cake, and there were almost 10000 events just in Sweden.

Linnaeus centennials; commemorative practices; comparaisons

ICHST
2017

A local company in a global market: Boots the Chemist and early medical internationalisation, 1883-1920

Hilary Ingram, University of Nottingham

Boots the Chemist originated as a small herbalist's shop in Nottingham UK and today is a large multi-national pharmaceutical retailer with American owners (Walgreens Boots Alliance), retail outlets in many countries, and an ever-growing international marketing strategy. As such, the history of this famous medical pharmaceutical retailer, manufacturer and researcher, epitomises the way a medical interest successfully expanded from modest local roots to a wide global market. Whilst the 'classic' history of the company (Stanley Chapman, 1974) argued that Boots began to think internationally from the end of the First World War, this paper argues that Boots had an awareness of the international world and the potential of learning from it, and trading with it, from much earlier on in its history. Showcasing a Wellcome-funded research project led by Associate Professor Anna Greenwood, this paper presents a small section of the research recently undertaken in the extensive, largely untapped, Boots company archives. It focuses on the early development of the company from its launch as a limited liability company in 1883, renamed Boots Pure Drug Company Ltd. in 1888, to its official (albeit short-lived) takeover by an American company in 1920. In this period, Boots established itself as the 'peoples' chemists' and seemed, on the face of it, only interested in growing its business in Britain. Yet, the development of this quintessentially national brand was hardly as British as it might on first impression seem. Boots relied upon strong international contacts to secure raw materials for manufacturing, to help grow their fledgling research department, and to find new products to bring to their British customers. In short, Boots was transnational before it consciously promoted transnationalism and presents a fascinating early case study of the way a pharmaceutical firm tacitly navigated the interface between the local and the global.

Boots; pharmacy; internationalisation; British; production

The Contributions for the chemistry teaching of Justus von Liebig and Heinrich Rheinboldt

Ingrid Nunes Derossi, Universidade Federal de Juiz de Fora

Ivoni de Freitas Reis, Universidade Federal de Juiz de Fora

The purpose of this research is approach briefly the german scientists' life Justus von Liebig (1803-1873) and Heinrich Rheinboldt (1891-1955) that have great contributions for the chemistry teaching in Germany and in Brazil, respectively, which belonged to similar methodological roots.

Liebig was born on May 12, 1803 in Darmstadt, he had contact with chemistry since he was child. Grew up with the productions of dyes, varnishes, pigments and another products that his father made to sell, in addition, he attended the lectures of chemists from other cities who visited the fairs of Darmstadt doing outdoor experiments for the population to disclose the science. (BROCK, 1997) He dropped out of the gymnasium in 1817, when he was fourteen years because, according to his autobiographical notes, the curriculum and the pedagogical approach did not match with him, the main focus was on linguistics and he was interested in understood much more of science and experimentation. (LIEBIG, 1892).

His students admired him because of his differentiated method of teaching. He brought concrete knowledge from the chemical experiments, he performed, explained, and justified them in his classes. Liebig allowed his students to expand their knowledge independently, through their own research. Heinrich Rheinboldt was born on August 11, 1891, in Karlsruhe. His academic life was heavily influenced by his grandfather Heinrich Caro, chemist, and one of the founders of "Badische Anilin und Sodafabrik". In 1934 he moved to Brazil at the invitation of Professor Teodoro Ramos to organize

ICHST
2017

and direct the course of chemistry at the Faculty of Philosophy, Sciences and Letters in São Paulo. In the records of his students it is possible to see that Rheinboldt's teaching methodology was differentiated, in all their speeches they praise the dedication and clarity of his explanations, always accompanied by demonstrative experiments and presenting a student-centered concern. It can be seen that his methodology was based mainly on experimental activities, according to him, students should learn to think through phenomena. Thus it would be necessary to see the phenomena many times to become familiar and to think chemically, avoiding to decorate disconnected things and isolated facts. Similar speeches to those of Liebig and reiterated by his students. (GIESBRECHT,1957)

Liebig; History of Science; Rheinboldt; Teaching

Thinking Pharmacy and Dentistry in São Paulo by a gender bias (1895 – 1914)

Isabella Bonaventura de Oliveira, USP

This work intends to present some data obtained during the master's research, in progress since February 2015. This research aims to follow the paulista's pharmacists and dentists that formed associations in order to create a professional field separated from the medicine, in the beginning of Brazilian's Republic. Pharmacists and dentists sought to delimitate a professional identity, establishing what kind of knowledges and objects would make part of their practices, as well as who would be authorized to practice them. At that moment, we can observe in São Paulo the foundation of periodicals, scientific societies and schools focused on the interests of these professionals, such as the School of Pharmacy, founded in 1898, that annexed the courses of Dentistry and Obstetrics in 1903. This paper discusses how, in this period, it was still unclear what were the specific attributions and objects that would make part of the pharmacist's and dentist's occupation. To form a professional field, the paulista's pharmacist and dentists assembled in Scientific Societies intended acquire the authority to speak and act in these areas. In this sense, they created an image of the "scientific" pharmacist and dentist as opposed to the charlatans. This demarcation was based on the establishment of certain methods that should be followed by these professionals when dealing with their objects of work, such as chemical compounds, glassware, scales, teeth and prostheses.

The analysis of the periodical journals of Pharmacy and Dentistry allows affirming that these professions were permeable to the presence of women, especially after the creation of the School of Pharmacy in 1898. Therefore, this research also proposes to investigate how the institutionalization of Pharmacy and Dentistry was permeated by gender conceptions and speeches about them. We purpose to think about the relationships and possible disruptions that were established in this encounter between the formation of a professional identity focused on the production of scientific knowledge (identified with male) and the presence of women (usually attached to family and maternity). In order to achieve these objectives, we analyze how the female students of the School of Pharmacy and Dentistry acted in the composition of the knowledges, practices and objects that would make part of the professional identity of the pharmacist and dentist in the Brazilian's First Republic.

Gender, Dentistry, Pharmacy, Women in Science

Curious and Powerful Men in the Globalized World of Early Modern Science: Agents and Intermediaries of New World's Natural History in Central Europe

Jana Cerna, University of West Bohemia, Faculty of Philosophy and Arts in Pilsen; Faculty of Science, Charles University in Prague

The aim of the paper is to analyze the ways and means of the New World's natural history introduction to Early Modern Central European nobility and scientific circles (mainly Czech, via Iberian peninsula and Austria). The local processes of knowledge reception and production will be studied as an organic part of global mechanisms of knowledge production and circulation. The special attention will be paid to the ambience of Habsburg's courts, primarily to the broker's role of Hans Khevenhüller, the imperial ambassador in Spain and a buying agent, the key player involved in the procurement and transport of rarities between Iberia and Central Europe. The paper will reveal the Khevenhüller's strategies as well as his network of informants. The attention will be also paid to Johannes Faber, the Papal doctor, botanist, and member of the Accademia dei Lincei, as the intermediary of New World's natural history in Central Europe.

New World's Natural History; Early Modern Science; Central Europe; Hans Khevenhüller; Johannes Faber

The performance of Giovanni Battista Carbone, the formation of networks and the improvement of astronomical practices in Portugal (1720-1750)

Jefferson dos Santos Alves, Universidade Federal do Rio de Janeiro

The Neapolitan Jesuit Giovanni Battista Carbone (1694-1750) was sent to Portugal in the early 1720s and worked on the construction of the Observatory of the College of Santo Antão and the Royal Observatory (located in the Ribeira Palace) between 1722 and 1724. After of construction he was designated royal mathematician, received the title of minister and, and, in 1749, became rector of the College of Santo Antão. In both observatories, Carbone made astronomical observations and maintained scientific correspondence with other astronomers, which can be verified in scientific journals, such as Philosophical Transactions of the Royal Society of London, which contain his reports of observations and reports of other astronomers sent by him. The journals also present articles in which these works are cited in investigations of celestial phenomena, as that one written by the English astronomer James Bradley (1693-1762) in an article published in 1726 in the Philosophical Transactions. Through Carbone's observational reports, or reports transmitted by him, and the citations of these by other astronomers, we will see if there was a new dynamics of teaching and astronomical practice in Portugal in the eighteenth century, as well as an integration of Portuguese observatories in discussions about celestial phenomena, in view of the search for the improvement of mathematical knowledge in Portugal by the Portuguese Crown and by the Society of Jesus. We will also examine to what extent Carbone was embedded in a network of astronomical information exchange through scientific journals. We will also examine to what extent Carbone was embedded in a network of astronomical information exchange through scientific journals.

Astronomy; Society of Jesus; Portugal (18th century)

Knowledge dissemination in technology from Japan to China: the East Tour Diaries 1894-1911

Jian Yang, Tsinghua University

Delin Qu, Tsinghua University

Lei Wang, Tsinghua University

After the two opium wars, in order to maintain their ruling state, the Qing government decided to promote the sending of bureaucrats to Japan to learn advanced experiences of the Meiji Restoration. These bureaucrats wrote tour diaries in which they recorded investigation reports as well as research documents about what they had seen in Japan in the form of diaries after their back to China. We collect these tour diaries which were published between 1894 and 1911, by using the approaches of textual analysis, social context analysis, and comparative study to analyze science and technology-related records in them, thus discuss the function and limitation of technology dissemination from abroad at that time, as well as its role in the establishment of modern scientific and technological institutions in China. Furthermore, we also compare the East Tour Diaries case with the Japanese Iwakura mission case, to discuss what influencing factors indeed decide the quality of trans-national technology transplant and play most important role in the development of scientific and technological institutions in modern China and Japan.

East tour diaries; Japan; late Qing Dynasty; knowledge dissemination; bureaucrats

"Music's Effects": Music Therapy in the Encyclopédie

João Luiz Garcia Guimarães, Fiocruz

In the following paper I intend to investigate the medical and psychological knowledge involved in the elaboration of a music therapy proposal written by Jean-Joseph Ménuret de Chambaud for the Encyclopédie around 1765. Ménuret was born in Montélimar in 1739 and became doctor from the medical school of Montpellier in 1757. In 1758, he has been introduced to Diderot by Gabriel-François Venel (1723 – 1775) and began his collaboration with the dictionary, composing around 80 articles. After finishing his task, Ménuret spent most of his lifetime as an attending physician at the Montélimar Hospital. He returned to Paris in 1785, where he became doctor in the Écuries Royales and physician to the Comtesse d'Artois until the Revolution, when he joined the army as physician to the general Charles François Dumouriez (1739 – 1823). During the Terror, Ménuret went into exile at Hambourg and would only see Paris again a few months before his death in 1815.

Objectives

I intend to problematize the relation between mechanism and vitalism present in the entry “Effets de la Musique”, authored by Ménuret de Chambaud. Considered by the recent historiography (REY, 2000; WILLIAMS, 2003) as an exponent of “Montpellier vitalism”, Ménuret establishes his therapy upon two axes: the effects of sound as a physical force and the effects of the “modified sound” – Music – over individual sensibility. I sustain that his explanations for the action of music over living beings are still deeply mechanical, stressing the importance of Charles Wolfe’s definition of vitalism as an “expanded mechanism” (WOLFE & TERADA, 2004, p. 555).

Conclusions

In this brief empirical study, it is possible to verify the coexistence of mechanistic and vitalist explanations. Sound, as a physical force, is responsible for a considerable number of regular actions over the body: its vibrations affect the bodily fibers and humors. Its impressions on the feelings, however, may vary according with the listener’s sensibility. As an important vitalist concept, sensibility acts as a link between the physical and the moral domains and tries to explain how environmental stimuli affect men’s health.

The history of deaf education and its relation with aspects of Peirce's Semiotics

Jomara Mendes Fernandes, Universidade Federal de Juiz de Fora

Ivoni de Freitas-Reis, Universidade Federal de Juiz de Fora

Waldmir Nascimento de Araújo Neto, Universidade Federal do Rio de Janeiro

There are few studies that investigate the teaching and learning process of deaf students' sciences. More limited are the studies that relate the history of the process of acquisition of scientific knowledge of these subject with the contributions of Peirce's Semiotics. Therefore, using the discursive textual analysis of articles, dissertations, theses and websites, our objective in this work is to point out how the educational method of deaf people arise and what is the relation with the presuppositions that guide the studies of the Semiology for the acquisition of knowledge. It was with the french abbot Michel De L'Épée (1712-1789) that deaf education became systematized. L'Épée noted that two of her students, congenital and deaf twins, created a kind of sign language that they understood. Adopting this system of communication developed through the twins, the abbot spread the possibility of an autonomous system, not based on an oral language, but based on the visual experiences of the deaf (REYLE, 2007). He was the first to recognize in sign language a logical means of communication.

It is natural for humanity to have the ability to create various ways of communicating with one another, and thus language is established through the association between the things that are perceived and the ideas aroused by that perception (CHAMARELLI FILHO, 2008; VYGOTSKY, 1993). Semiotics, originated from the greek word "semeion", designates the science of signs. The term is an introduction of the philosopher John Locke (1632-1704) with the "Study of the signs in General". Ferdinand de Saussure (1857-1913) together with Sanders Peirce (1839-1914), are considered the precursors of contemporary semiotics; while the first made only a mention of the science of signs, the second researcher constructed the triadic theory of the sign (its representation, its object and its interpretant).

For Peirce (2005), language is all that involves meaning for the subject and because deaf people use semiotic identification and have a very well-founded culture, is evidenced an intrinsic relation between their learning processes and the studies of the imaginary semiotics. We conclude, however, that this relationship is an unexplored area. We understand that Semiology as fundamental in the construction of the learning of deaf people that, through sign language, can establish bridges of significations with knowledge.

Deafness, History, Semiology, Learning, Peirce

A certain group of neglected diseases in the tropics: nutritional deficiency diseases and the debate with infectious diseases at the turn of the nineteenth and twentieth centuries

José Divino Lopes Filho, Universidade Federal de Minas Gerais

In the article "The Blue Marble", 2011, G. Petsko highlights the value of the land image seen 45,000 km away. The photo became a symbol of environmental activism in the 1970s. For Petsko, despite several images associated with science, none of them will do what "The Blue Marble" did for environmentalists, uniting generations around a cause. In 2013, P. Hotez cites the "Blue Marble Health" concept to discuss the spread of neglected tropical diseases (NTDs) in developed and

developing countries. He affirms that the reference to the photo of the earth as a symbol of peace, stimulates a global dialogue on the importance of poverty as a key element for the presence of NTDs. NTDs is a group of parasitic and bacterial diseases that affects more than one billion people in the world. The knowledge of these diseases grew from the second half of the nineteenth century. Scholars proved Henle's theory, which in 1840 stated: "the germ needed to be identified in the affected organism; Be isolated and cultured in a pure environment; Then it is necessary to reproduce the disease in laboratory animals, from which it would then be necessary to recover the germ". Also in the second half of the nineteenth century studies already showed the role of nutrients in the determination and prevention of diseases, but without the strength of infectious disease theory. This theory provided a rapid development of intervention tools, making public health efforts effective in reducing the incidence and mortality of some diseases. According to R. Mckeown "public health comes to be seen largely through the lens of infectious disease prevention and control." Unlike the action of the infectious agent, nutritional deficiencies have several causes, including food and nutritional insecurity. According to Baily et al., the three main nutritional deficiencies are: Iron, whose deficiency affects more than 30% of the world population; Vitamin A, whose deficiency causes between 250-500 million cases of childhood blindness and Iodine deficiency affecting 2 billion people. As for NTDs, the three most prevalent are: Ascariasis, with a global prevalence of 807 million people; Trichuriasis, 604; Hookworm infection, 576. So instead of prioritizing theories - as it did in the debate between infectious diseases and nutritional deficiencies diseases - public health should clearly assume that it is part of the environmentalist project to save "The Blue Marble" by meddling in all causes this project is proposed.

Neglected tropical diseases; Nutritional deficiencies diseases; The Blue Marble

The History of Mathematics as one of the paths of mathematical educators in the first decade of the 21st Century

José Lamartine da Costa Barbosa, Universidade Estadual da Paraíba
Raíssa Barbosa da Costa, Universidad Tres Febrero

This study deals with the History of Mathematics in the National Meetings of Mathematics Education in the 21st Century, held in Rio de Janeiro, Recife, Belo Horizonte and Salvador, respectively, in order to undress the various discussions that took place in the first decade. For this, we decided methodologically, through a systematic review of studies in the field of Mathematical History, using specifically the annals of VII, VIII, IX and X ENEM, organized by SBEM - Brazilian Society of Mathematical Education. In this sense, mini-courses, round tables, scientific communications, posters and lectures were analyzed, selecting the articles that make theoretical reflections or report on the possible support of the History of Mathematics in teaching and learning situations of Mathematics. In this way, the authors, titles, objectives, contents, methodologies and if there was experience in the field were identified. The development of the present research is enabling a systematic analysis of how studies in Mathematical History are developing, providing a reflection about the benefits of using History as an auxiliary pedagogical and methodological resource in Mathematics Education. In addition, it is also allowing to analyze the regions of the country in terms of publications in the area of History of Mathematics in the first decade of the 21st century.

History of mathematics; Systematic review; Mathematical learning

Science and Faith in Debate: a Brazilian experience

Josué Bertolin, Universidade de São Paulo

Science and religion are two important foundations of human society. They both have a direct or indirect influence on people's lives. However, in common sense, the idea that there is an irreconcilable conflict installed between reason and faith has been consolidated. Such antagonism has trivial advertising. Sometimes a reductionist approach to the subject is noticed. When studying the scientific development throughout history, it is inevitable to consider its relationship with religious thought, or systems of religious belief, or even with religious institutions. This relationship is complex and multiple-sided, and they have contributed to the development of one another, consciously or not. The theory of conflict is not a satisfying explanation for the historical evidence. Therefore, this work has the purpose to discuss the relationship between science and faith, from a historical perspective, analyzing, among the Brazilian initiatives, the activities of the civil society organization Legion of Good Will. A research of its propositions, since its foundation in January 1, 1950, for the purpose of bringing together science and religion, along with a discourse analysis, present elements that broaden the debate on the Brazilian experience in the field of scientific and religious dialogue. Under these terms, this research seeks to understand how is it possible to have a more productive exchange between science and religion, considering the aspects of a Brazilian contribution.

Science; Religion; Progress

Trends in science cooperation in South america: between subordinate integration and horizontal cooperation, 1990-2009

Juan C. Góngora A., IVIC (Instituto Venezolano de Investigaciones Científicas)

This work is related to science cooperation in South america, at the turn of the century, between the last decade of the 20th and the current century, in a period characterised by major geopolitical changes in both, regional and global dimension. In this context, we endeavour to give answer to the questions: how have they been understood, by the subjects of international relations, regional integration and the process of scientific cooperation in the last few decades? What are the priority areas for scientific cooperation in the region? Also, this paper propose as categories of analysis: subordinate integration and horizontal cooperation, which allow us to understand the predominant trends in the history of scientific cooperation in South America between the 20th and 21st century. In a particular way, the regional science cooperation is shown as part of multi-polarization in international relations, from the beginning of the 21st century, which has as a correlate multipolarization of science and horizontal cooperation, especially in the South-South direction. The work is based on the critical-historical method and the comparative analysis of the most important features of the scientific cooperation at the regional level, with emphasis on Argentina, Bolivia, Brazil, and Venezuela; in this sense, we studied cooperation agreements signed at the governmental level, foreign policy and the regional geopolitical context in the period 1990-2009.

science cooperation; Subordinate cooperation, Horizontal cooperation, South America

Chemical industries and pine resin. How world demand of raw materials arrives and develops in Mexican forests during 19th and 20th centuries

Juan Luis Delgado, Instituto de Geografía. Universidad Nacional Autónoma de México

At the turn of the 18th to the 19th century, commodities market was enriched by pine resin by-products due to scientific advancements. Chemical industries such as paint, varnish, paper, soap, rubber, etc., recognized in the spirit of turpentine and rosin a very convenient commodities for its production process. In this vein, many pine forests began its slow but steady history of industrialization, especially in United States and Western European countries. Since then chemical and resin industries were growing rapidly. In the last third of the 19th century the increasing demand of those derivatives urge the need to find some more pine forests around the world where pine resin could be easily and cheaply obtained. Mexico, a well-known land of pines, was one of these places. American, French, Spanish, and even Mexican entrepreneurs began operations at the turn of the century. In spite of some restricted uses of resin for medicinal or illuminating purposes by rural and indigenous people, neither Mexican pine forests nor the villagers had any experience in the business. Everything was to be done. This paper is an environmental history of a technology transfer which will try to tackle the complexities of the arrival and development of a new forest chemical industry; between international commodities market needs and local people and forests (with national, regional and local traditions and regulations as a powerful mediators), but especially between an old and a new way to use, perceive, and preserve natural resources in Mexico. . In pine forests of Michoacán was where this activity rooted better than any other region. The probable cause was the profitability of its pine resin yield, but community organization and politics (in the three levels of the administration) were pretty relevant as well. Hence, the aim is to connect the history of those towns where tapping the pines became an income option with that of the inertia of international chemical and resin industry.

chemical industries; technology transfer; raw materials; Mexican pine forests; 19th and 20th centuries

Naturalism in BAAS during Nineteenth Century: Philosophical and Ideological Debates

Juan Manuel Rodriguez-Caso, UNAM

The emergence of the British Association for the Advancement of Science (BAAS) in 1831 represented a milestone for science, by bringing it within reach of a wider audience, but contrary to what it can be inferred from the name of the Association, from the very beginning the promotion of science that arose within the Association was framed in redefining its practice within the context of natural theology. In this sense, the current concept of naturalism during this time was far from a unified idea, and, in fact, at least during almost the first 30 years, it was defended by the gentlemen of science a position close to an idealism. It was from the 1860s when it was proposed a different view of scientific practice, scientific naturalism, by Thomas H. Huxley, which has been consolidated as an alternative to scientific materialism proposed by John Tyndall, although it is true that we will owe this consolidation – at least in a historiographical sense – to the work of Frank M. Turner. Much of the discussion raised by Huxley, and later recovered by historians, emphasized the dichotomy between what Huxley himself considered a supernatural stance related to natural theology authors, and a genuine naturalism that he considered opposed to that traditional stance, both methodologically and philosophically. Considering recent works on Victorian science history, such as Matthew Stanley's *Huxley's Church and Maxwell's Demon* (2014) and Bernard Lightman y and Gowan Dawson's *Victorian Scientific Naturalism: Community, Identity, Continuity* (2014), it will be presented the context of discussions within the BAAS around the concept of naturalism, especially in sections devoted to the natural sciences, such as Section A (Mathematics and Physics) and Section D (Botany and Zoology until 1865, renamed as Biology from 1866, by the influence of Huxley). From examples of presentations and presidential addresses, it will be seeking to show the different conceptions of naturalism present in the Association during the nineteenth century.

Naturalism; gentlemen of science; religion; natural theology

Between naturalia and artificialia: the "human" at the Salvador's Cabinet of Curiosities

Julianna Morcelli Oliveros, Institució Milà i Fontanals - Consejo Superior de Investigaciones Científicas (IMF-CSIC)

From the Renaissance to the Enlightenment, a new "fashion" prevailed in circles services across Europe. Collecting became both a hobby and a code of conduct for those who wanted to either affirm or achieve a certain social reputation. Everything that was considered curious or wonderful was worthy of being collected.

These collections allowed their owners and select visitors both to contemplate the representation of the natural world of divine creation and to assert the control that humans could exercise over nature through ordination, classification and exploitation according to their interests. This model of collection, the so-called cabinets of curiosities, was very recurrent in Europe between the sixteenth and eighteenth centuries. Much of it followed a model of structure, consisting of the collection of "curiosities", a library and a garden.

Just as it happened about port cities, Barcelona also had its cabinet of curiosities. For nearly two and a half centuries, a family of apothecaries and naturalists have maintained a cabinet that has been connected with other important naturalists and collectors and within all new developments in colonial trade.

The human body became part of scientific collecting from the sixteenth century, and the cabinets of curiosities, with its profusion of natural and artificial objects, one of the exhibition spaces of pieces, models, preparations and anatomical drawings. Although it has not resisted until our days - reason why it is not possible to affirm strongly its presence or absence - everything indicates that these objects also were part of the Salvador's collection. In any case, it is still possible to find the presence of the human, which is not limited to the bezoar stones.

In this sense, my main objective is to analyze the works specialized in anatomy that form the library of this family. Having as contextual framework the Republic of Letters and the circulation of knowledge, anatomy books were important instruments of information and dissemination of knowledge about the human body.

Scientific collecting; Human Body; Republic of Letters; Barcelona

Une police médicale?: La santé publique et "l'Intendência Geral da Polícia" au Portugal des Lumières (1750 – 1792)

Julie Hamacher Liepkaln, Unicamp

Le XVIII^e siècle a été un moment paradigmatique dans l'histoire de la science et, plus spécifiquement, dans l'histoire de la médecine. Pendant le siècle des Lumières, le débat sur les idées de liberté, progrès et raison est devenu plus intense. Les savants ont réfléchi à leur propre réalité, qui pourrait être modifiée à travers la connaissance et la science.

Par ailleurs, les savants se sont dédiés au but de rendre la raison publique et transmettre le savoir "légitime". Pour ces gens-là, le savoir, qui était autrefois hermétique, aurait dû être disséminé. Dans ce sens, les sociétés scientifiques et les académies, des espaces destinés à la construction de la connaissance, ont été des environnements intellectuels et coopératifs emblématiques.

Dans cet article, on fera attention à ces espaces et ces réseaux, avec l'objectif de mieux comprendre comment la circulation des idées a configuré de nouvelles notions de santé et, plus que cela, de nouvelles mesures destinées à la sauvegarde de la santé publique. Si au début on met l'accent sur le

cadre global – la circulation des idées et de nouvelles théories médicales en Europe des Lumières – on cherche aussi de faire attention au cadre local – comment ces idées ont promu des politiques publiques pendant la deuxième moitié du XVIII^e siècle au Portugal.

Dans ce sens-là, l'Intendência Geral da Polícia se dévoile un élément important pour la compréhension des rapports entre le global et le local. L'Intendência Geral da Polícia possédait des responsabilités considérables: l'assainissement urbaine, l'approvisionnement et la qualité des aliments, la surveillance des épidémies, l'assistance aux malades, la formation des travailleurs de la santé et le recensement de la population.

Néanmoins, quelques questions se posent: Quels étaient les défis locaux pour l'Intendência? Comment les nouvelles idées sur la santé ont été incorporées et ont consolidé des politiques de santé publique?

Face à ces questions-là, on propose dans cet article une réflexion aux rapports entre la circulation des idées scientifiques et les mesures vers la promotion de la santé publique. Il s'agit d'un effort primordial d'articuler le global et le local, en élucidant le contexte culturel et scientifique de l'Europe des Lumières et aussi le développement et la consolidation d'un projet de santé publique ajustée aux spécificités locales du Portugal du XVIII^e siècle.

Médecine; Santé publique; Lumières; Portugal; Intendência Geral da Polícia

Arab Space Science: Cosmopolitanism and Nationalism

Jörg Matthias Determann, Virginia Commonwealth University in Qatar

Middle Eastern astronomical discoveries and cosmopolitanism are commonly and romantically considered features of past eras. The golden age of Arabic and Islamic science is usually located in the Middle Ages, and said to have been followed by stagnation and decline. In an equally nostalgic way, cosmopolitanism in cities like Aleppo, Alexandria and Casablanca is often associated with Ottoman imperial and European colonial times. The rise of nationalism and Islamism in the twentieth century are often blamed for the destruction of diversity and end of tolerance in the region. In contrast to these views, I argue that Arab countries and their scientists have continued to contribute to space exploration and cosmopolitanism until the present. Using telescopes and engaging in transnational collaborations, astronomers in modern Egypt and Qatar have made important discoveries and named new celestial bodies. Looking at Earth from American and Soviet spacecraft, a Saudi astronaut and a Syrian cosmonaut also began to see our planet without national boundaries. However, rather than being hampered by nationalism, transnational collaborations in the fields of space science largely depended on funding by national governments in search of development, prestige and security. Many Arab space scientists thus equally expressed loyalty and belonging to their home country, the wider Arab and Islamic world, and our planet as a whole.

space science; astronomy; Middle East; cosmopolitanism; nationalism

Two Maps of Asia Minor: A Comparison of Joan Blaeu's and Abu Bakr b. Bahram Al Dimashqî's Works

Kaan Ucsu, Istanbul University

Justinus Colyer, Dutch ambassador to Istanbul, presented the most luxurious atlas ever published, Atlas Maior, to Ottoman Sultan Mehmed IV in 1668 upon his arrival to Ottoman lands. An Ottoman geographer named Abu Bakr bin Bahram al-Dimashqî was charged with translating this atlas into

Turkish in 1675. After almost a decade a reduced and altered translation of *Atlas Maior* completed in 1684/1685 in 11 volumes as it is with Latin version. After a short while, al-Dimashqî prepared an abridged version (*Ikhtisâr-ı Tahrir-i Atlas Mayor*) of this translation in two volumes, which is found among the treasures of Topkapı Palace today.

This paper aims at comparing the maps of Asia Minor in two atlases, namely Latin version of *Atlas Maior* and abridged version of its translation (*Ikhtisâr*), in terms of cartographic representation, toponyms and the text accompanying maps within atlas.

Atlas Maior, Joan Blaeu, Abu Bakr b. Bahram al-Dimashqî, Asia Minor, Ottoman cartography

Smithsonian Female Meteorological Observers: A History of Women in United States Meteorology

Kae Takarabe, Chubu University

The purpose of this presentation is to explore the history of women in meteorology, an area that has received scant attention. The focus of this research is the female observers involved in the Smithsonian Meteorological Project (1848–1874) in the United States. At the heart of this Smithsonian Institution project was an extensive network of volunteer observers who kept weather journals following a common plan and who submitted their reports monthly by mail (Kopper 1983: 15-16; Fleming 1990: 75).

Following traditional historiography, Benjamin (1897: 665–666) listed 59 famous male observers out of more than 600 volunteers. About a century later, Fleming reported on a study where he used prosopography to attempt to uncover the attributes of non-elite observers, but this has remained unexamined. In the Appendix to his book (Fleming 1990: 175–184), he addressed 121 samples. Although Fleming did not specifically refer to female observers or their roles in the text of his book, this Appendix suggests the presence of two or more female volunteers, “Helen I. Whelpley,” “Florence [Whelpley],” and J. A. Applegate and “daughter.”

In contrast, Reed (1992: 16) calculated that a total of 31 women contributed 175 years’ worth of observations to the Smithsonian Meteorological Project between 1847 and 1861. At least one volunteer, Mrs. Lawrence Young of Kentucky, has been rediscovered (Kentucky Climate Center). Reed also referred to the participation of two educational institutions in the project before 1861. Other female observers have also recently been rediscovered (Connan 2007; Truesdell 2007). Such examinations, however, have been sporadic and limited to within local societies.

The collective and comparative analysis presented here relies on the “Classified Record of Monthly Meteorological Reports Preserved in the Smithsonian Institution” which appeared in the Annual Report of the Smithsonian Institution for 1873. This report includes data collected by more than 100 female observers, searched and extracted using female-related terms including Mrs., Miss, wife, daughter, Female Institute/Seminary, Anna, Celestia, Maggie, and Mary.

In sum, my research has uncovered the geographical, historical, and institutional dimensions of the practices of Smithsonian Institution female meteorological observers. My work serves to compensate for the current lack of a female-dimension in the history of meteorology.

History of meteorology; gender; women; Smithsonian Institution

Global Science, Local Challenges: Selim Lemström's geophysical expedition to Lapland and the First International Polar Year

Kallinen Maija, University of Oulu

The First International Polar Year, organized from 1881 to 1884 was one of the first truly international scientific projects to be accomplished within the physical sciences. Aimed at collecting basic data of geophysical and meteorological phenomena and the arctic nature, the Polar Year project was participated by all the leading European nations of the time. Finland, then an autonomous grand duchy within the Russian Empire, took considerable effort in participating and resourcing a geophysical expedition of its own to Sodankylä village in Finnish Lapland. My paper discusses first of all the way in which emerging nationalistic motives intermingled with scientific ones in the preparations of the expedition. I then move on to look at the expedition itself, and the practical difficulties the leader of the expedition, professor Selim Lemström (1838-1904) was having in conducting the various measurements he was supposed to do. My paper discusses, what kind of challenges both the northern environment and the local culture posed for the production of knowledge, and what kind of solutions were tried to overcome them.

The outcomes of the expedition were manifold. Scientifically, Lemström's measurements gained some international attention, but their eventual rejection had less to do with the inaccuracies of the measurements rather than with Lemström's theoretical framework and hypotheses in interpreting them. We can also see that Lemström's personal career as a scientist was both advanced and weakened by the undertaking. On the other hand, the infrastructure built during this project in Lapland led gradually to the construction of a permanent geophysical laboratory in Sodankylä.

arctic; geophysics; expedition; national science

A Farm in Africa: Paul Erdmann Isert and Botany in Eighteenth-century West Africa

Karen Oslund, Towson University

The botanist Paul Erdmann Isert (1756-1789) is best known for his efforts to end the Danish-Norwegian slave trade between the west coast of Africa and the Danish West Indies. In his *Letters on West Africa and the Slave Trade* (1788) he described the brutal conditions on the sugar plantations of St. Croix, St. Thomas, and St. John, and proposed an alternative to trans-Atlantic slavery: that the transport of African slaves to the Caribbean be ended and trade products be supplied instead by Danish-managed plantations in modern-day Ghana. Before his early death from tropical fever the following year, Isert succeeded in obtaining royal funding for one such experimental plantation at Frederiksnobel with land purchased from the Akwapim people. The goal of the plantation—rather advanced for its time—was to employ African and European workers together to produce tobacco and cotton for the European market. Although Frederiksnobel ultimately failed under the care of Isert's assistants, belief that such plantations could be economically viable contributed to the Danish-Norwegian ban on trans-Atlantic slavery in 1792 (which was put into effect 10 years later). My paper will examine the state of botanical knowledge and practice in West Africa at this time by looking at Isert's reflections on the flora and fauna of Ghana written before he launched Frederiksnobel. In these writings, he focuses on broadening scientific knowledge and finding "hitherto unknown to me" species of fish, shellfish, and insects, while animals unknown in Europe, such as the water buffalo, provide him with opportunities to consider general scientific theories, since their stature seems to "disprove the general opinion of the zoologists that in a hot climate mammals decrease in size." Isert pays little attention to practical matters of plantation crops which would be grown on Frederiksnobel. Yet, the Danish-Norwegian minister of finance, Ernst von Schimmelmann, used Isert's *Letters on West Africa and the Slave Trade* to argue that plantations in

West Africa would be more economically viable than those in the Caribbean. How did the state turn natural histories and scientific endeavors into knowledge useful for the state at this time? The paper will compare the relationship between natural histories of foreign territories and projects for useful improvements in eighteenth-century Denmark-Norway, comparing Isert's story with others from the North Atlantic colonies of the Danish-Norwegian state.

botany; plantations; West Africa; colonial knowledge; natural history

Cold War and the Nobel Prizes in Physics: A look into the nominations

Karl Grandin, Center for History of Science-Royal Swedish Academy of Sciences

The Nobel Prize in physics is awarded annually by the Royal Swedish Academy of Sciences according to the will of Alfred Nobel, made practicable by the statutes of the Nobel Foundation. During the two World Wars the awarding was partly halted, in 1944 Stern was awarded the 1943 Nobel Prize, so that becomes the starting point for this investigation. The year 1943 can also be seen as roughly the starting time for the Cold War. The Nobel archives are only open to research 50 years after the year a particular prize is awarded so the final year will here be 1966. An especially interesting case is the Nobel Prize in physics in 1964 awarded "for fundamental work in the field of quantum electronics, which has led to the construction of oscillators and amplifiers based on the maser-laser principle" to Townes from the US, and Basov and Prokhorov from the USSR. A symbolic event one might think. How did the Cold war influence the awarding of the Nobel Prizes, and what role if any did the Swedish policy of neutrality and non-alignment politics play? The basic question will be to what degree did Cold war politics influence the operation of the Nobel system? How did the local Nobel committee deal with the global international task, of not only choosing the Laureates, but also trying to get nominations from the world's divided community of physicists? This can be seen as part of the more general theme of nationalism, within the Nobel Prize process, a topic which has been addressed in earlier research. But the Cold war period also added other dimensions to this. From an investigation into the files of the Nobel Committee some observations and preliminary conclusions will be made. The sample is the Nobel Prize records in the years 1944–1966. Several questions may be asked. Were there nominations across the iron curtain? Was there discrimination for either side by the committee, when it came to invitations to nominate candidates? How did the Nobel Committee judge the two sides? Are there any biases that these samples indicate?

Nobel Prize; Cold War; Physics; internationalism in science; nationalism in science

German Folk Medicine in a Global Context: Jewish Refugees from Central Europe and the Politics of Homeopathy in the English-speaking World, 1938-1980

Katherine Sorrels, University of Cincinnati

This paper examines a little-known chapter in the history of homeopathy, a global medical tradition whose local rootedness is under appreciated. At the center of this story is the simultaneous, paradoxical embrace of homeopathy by the Nazis and the beginnings of a new chapter in its transmission outside of Central Europe through the work of Jewish homeopathic physicians who fled. These Jewish refugees brought with them approaches to health, ecology, and education that undergird some of the most established branches of alternative medicine, organic agriculture, and alternative education practiced in Britain and North America today. The paper focuses on the Viennese pediatrician, Karl König. König belonged to a circle of Jewish physicians, educators, and

ecologists around the philosopher Rudolf Steiner, founder of anthroposophy, a spiritual system that structures anthroposophic medicine (modified homeopathy), biodynamics (the oldest form of organic agriculture), and Waldorf education (an alternative school system). König established a network of intentional communities known as the Camphill movement, which blend homeopathic medical care, biodynamic agriculture, special education in residential care villages for people with disabilities. These communities embody the cultural and ideological tensions at the heart of homeopathy—their founding members came from the 1960s and '70s counter-culture, yet they embrace a conservative, ascetic lifestyle.

Recent literature on ecofascism and, more specifically, on the Nazi embrace of homeopathy and organic agriculture, has challenged the widespread tendency to see alternative medicine and ecology as litmus tests for the counter-culture and the political left in 20th century North America and Western Europe. Homeopathy, it is now clear, draws on a complicated blend of ideological influences. This paper uses the writings and personal correspondence of König and his close associates to show how Jewish homeopaths navigated this ideological landscape, how they situated homeopathy in Central European and Jewish holistic, mystical, and medical traditions, and how they breathed new life into movements for alternative medicine and ecology in the English-speaking world. This story underscores the ideological complexity of these movements and reveals it to be an artifact of the transfer across spaces and cultures of a medical tradition deeply rooted in local folk traditions.

homeopathy ecology medicine and ethnicity

Expanding the English Pharmacopoeia: American Drugs and Poisons in the Seventeenth Century

Katrina Maydom, University of Cambridge

In the seventeenth century, the English directly encountered exotic materia medica from their American colonies for the first time. The foundations of England's first empire were being established and an increasing variety and abundance of plant specimens arrived in England's ports from across the Atlantic. The marketplace for new world medicinal botanicals provides insights on the value the early modern English assigned these commodities. The changes in the import of medicines represented an expansion of the pharmacopoeia rather than a displacement of older medicines by new cures. Imports of more established medicinal herbs and concoctions from other European countries remained stable while imports of botanicals from the new world increased. The import of medicinal plants to England reached unprecedented levels in the seventeenth century due to a high demand and consumption of these plants.

While the 'new world' was viewed by many as a paradise, full of wondrous healing botanicals with quasi-miraculous effects, others viewed the foreign flora as unfit for English bodies. Some medical practitioners worried about the dangers of consuming such herbs and fruits based on the relationship between an individual's constitution and environment. A counter-argument was made by others, however, that the new colonies were now English land and thus their remedies suitable for the English people, albeit with some modifications. From the English Civil Wars to the Glorious Revolution, English society and its material culture experienced an interesting consolidation of earlier views on materia medica with new debates arising from England's expanding empire.

How did the English interpret and represent the healing virtues of American exotica during an early period of western imperialism in the seventeenth century? This paper will contribute to understanding the significance of new world materia medica in early modern English medicine by examining the reception of American drugs and poisons in English pharmacopoeias, medical recipes and herbals. I will compare official and unofficial sources to assess the role of authorities in shaping the adoption/rejection of colonial exotica. I will discuss the process of introducing new world flora to the English marketplace, what claims of efficacy were made of foreign remedies, and why some

specimens became widespread commodities while others were rejected by and excluded from English medical practice.

early modern; medicine; empire; america; england

UK-US relations and their influence on the UK's political warfare and atomic energy strategy towards Japan

Kenzo Okuda, Toyota Motor Corporation

The US and the UK had mutual relations regarding atomic energy from the time their nuclear weapon research began. The UK pursued a nuclear weapons development programme called "Tube Alloys" in World War II. After the UK and the US signed the Quebec Agreement in August 1943, "Tube Alloys" was subsumed into the US Manhattan Project. Both countries cooperated closely to develop atomic bombs, which were dropped on Hiroshima and Nagasaki in August 1945.

After the war, the US banned the Japanese original atomic energy research, but allowed its introduction of atomic energy to Japan through its "Atomic Energy Peaceful Use" program. Meanwhile, in the UK, research institutes and military authorities cooperated on nuclear development under the order of the government.

During its occupation of Japan, the US used a careful psychological warfare for democratization and recovery of Japan and also for mitigating there the influence of the Soviet Union and communism. In 1948, three years after the end of the war, the UK established the Information Research Department (IRD) and began to pursue its own political warfare in Japan. The primary purpose was the consolidation of democracy in free countries threatened by communism. However, its efforts were checked by the US occupation. After Japan became independent, the UK was able to pursue its political warfare freely.

After ending its occupation of Japan, the US maintained strong influence over the country. Nevertheless, Japan was now relatively free. In May, 1955, it invited "the Atomic Energy Peace Mission" from the US. However, after that, Japan greatly changed its policy of the introduction of atomic energy and started negotiations with the UK because the US was behind in substantial nuclear energy development.

The UK Government and its Atomic Energy Authority too desired a close cooperation with Japan while being conscious of the US. This cooperation led to Japan purchasing from the UK a Calder Hall type reactor. This was the first commercial nuclear reactor in the Japan. The UK was able to introduce to Japan nuclear reactors thanks to its mutual understanding with the US regarding nuclear energy that began before the war. Of course, the UK kept close relations with the US, while it was working with Japan on nuclear energy. Nevertheless, it developed its own psychological warfare and atomic energy policy in Japan.

UK-US relation; political warfare; atomic energy; Information Research Department (IRD); Calder Hall type reactor

Twin Modernities: Medicinal plants and race as dual national projects in Brazil

Kerri Brown, Southern Methodist University/Fiocruz

Brazil's legally-binding pharmacopoeia, first published in 1926, began to establish pharmaceutical norms for medicinal plants and preceded, by decades, more global efforts to regulate the use and cultivation of medicinal plants. As medicinal plants have, since the middle of the 20th century,

become more intricately woven into intellectual property, pharmaceutical, environmental, technological, and health policies on an international scale, several countries have moved towards a nationalized model of medicinal plants. National pharmacopeias have become highly political bodies of knowledge, as in the cases of China (Farquhar 1996), India (Ganguly 2012), Tibet (Craig 2012; Adams 2001), Vietnam (Walhberg 2014), Mexico (Soto 2009; Hayden 2003), Ghana (Osseo-Asare 2014), Madagascar (Osseo-Asare 2014), and South Africa (Ives 2014), among others, including Brazil. Brazil has established itself as a significant interlocutor within these international conversations and has over the past 20 years developed increasingly comprehensive national policies regarding medicinal plants. In this paper I present a historical and discursive analysis of Brazil's policies from the perspective of this nationalization, paying particular attention to their development as a result of constant international dialogues. Core issues such as territory, healthcare, and cultural rights are often based on notions of race and ethnicity in Brazil, and have in recent decades become of interest to policymakers and activists alike under this light. Therefore, in this paper I specifically trace conversations between Brazil's nationalization of medicinal plants and the country's national projects of racialization, drawing on ethnographic, historical, and political sources.

Plants; biodiversity; intellectual property; policy

Johann Peter Frank in the Russian Empire: 1804-1808

Kostiantyn Vasyliiev, Odessa National Medicine University, Ukraine

Juriy Vasylyev, Sumy State University, Ukraine

Johann Peter Frank (1745-1821) was the author of the well-known work of the medical police system («System einer vollständigen medicinischen Polizey»; 1779-1817). In 1804-1808 J.P. Frank worked in the Russian Empire. This period of his life and work still has not been sufficiently investigated.

Initially, he was a Professor of therapy in Vilna University (now Vilnius, Lithuania). Then he was invited to St. Petersburg. In the capital of the Empire, he was not only Professor of therapy in the Medical-Surgical Academy (now the Military Medical Academy). At the same time he was the Rector of the institution. In addition, he was a member of the "Main school management" of the Ministry of Education. Main school management performed the role of the board at the Ministry of Education. Management meetings were chaired by the Minister. The management made regulations and university plans, as well as resolved other issues of higher education institutions.

In November 1805 I.P. Frank submitted to the Minister the plan to transform the Medico-Surgical Academy, which provided for the expansion of the teaching program. There was a "medical police" in the list of courses that were taught to students. At the same time the Minister gave his consent to the plan. Thereafter I.P. Frank, basing himself on his plan to transform the Academy, made its charter. The charter was considered and approved by the Main school management. Then in 1806 the charter of the Medical-Surgical Academy was approved by the Emperor Alexander I.

In accordance with the charter it provided 10 departments at the Academy. One of these departments was called "military medicine, medical forensic science and medical police". As you can see, the Professor of the Department of the Medical-Surgical Academy taught three educational disciplines. 1. Military Medicine; 2. Forensic medicine; 3. Medical Police.

Although in 1808 I.P. Frank left Russia, but his ideas were taken into account in the future in the new department of the St. Petersburg Medical-Surgical Academy as well as in the department of the Universities of the Russian Empire.

J.P. Frank; 19th century; medical police

Foreign, local, useful and rare. Classifying drugs in Paris circa 1700

Laia Portet Codina, Cambridge University

My doctoral thesis analyses how the interest in exotic drugs impacted the medical world of Paris between 1660s and 1730s by encouraging objective knowledge whilst influencing consumption and taste. The last decades of the 17th century have been signaled as the turning point in European domestic and overseas trade patterns, as well as in the ways of making scientific knowledge and employing natural history for profitable purposes. Recent research on Atlantic history, history of consumption, history of science and history of food have revealed indeed that the commodification of traditional imports such as spices, sugar, rhubarb as well as other unknown vegetal substances from Africa, Asia and America started as early as the midst 17th century in France. By this time and in the context of the colonial race, the possession, consumption, study and display of exotic materials were an exhibition of potency, taste and magnificence. In this respect, many scholars have conducted revealing studies about the moral, economic, cultural and politic dilemmas involved in the consumption of foreign products. The complexity of having access to rarities, naturalia and manufactured goods from all over the world, as well as of acquiring reliable information about the natural history, inner proprieties and possible uses of exotic simples has inspired remarkable scholarly work, too.

Conversely, though, little attention has been paid to the process of establishing a stable identity to non-domestic simples in the metropolitan sites where these products were sold, the construction of the concept of exotic within the early modern medical world and the terminology related to remedies from colonial lands in printed materia medica.

On one hand, then, my paper will assess the globalization of the medical marketplace of Paris by exploring how drugs were identified, classified and discussed in French printed pharmacopoeia and medical treatises. On the other hand, by paying attention to the actual vocabulary used in the description of foreign, unfamiliar drugs my study will also discuss the convenience of labeling certain drugs -such as pepper or calamus- as exotic when examining their role in singular early modern contexts.

Early Modern Medicine; French History; Cultural History

From Rhesus Monkey to Cynomolgus Monkey: When a Local Political Decision impacts a Universal Scientific Practice

Laure Hoenen, Strasbourg University

December 2nd 1977, the Indian government decided to ban export of native monkeys, stopping the supply of rhesus monkey (*Macaca mulatta*) of research laboratories worldwide. Indian Prime Minister Morarji Desai's decision resulted from revelations made by the International Primate Protection League (IPPL). After unsuccessfully trying to raise U.S. government awareness about American military researches on neutron irradiations involving rhesus monkeys, IPPL called upon the Indian government, on the basis of that the US-Indian agreement limited the use of monkeys for vaccine testing and medical research. The decision was effective from March 31st 1978 and set the cat among the pigeons. It appears that soon after, the rhesus monkey had been replaced by the cynomolgus monkey (*Macaca fascicularis*) as primates models in biomedical research.

By going into this episode in depth, the paper aims on one hand to question the choice of a particular species as a model in the biomedical field and to see the impact of a local political decision on universal scientific choices that will lead to a new standardization.

History of Biology; 20th century; Primates; Biomedical Research

A Miraculous Ascension. Materialism as a political tool for the prosperity of socialist/communist society. A case of science in Poland of the second half of 1940s and in the 50s

Leszek Zasztowt, Committee for the History of Science and Technology Polish Academy of Sciences

Leszek Zasztowt A Miraculous Ascension. Materialism as a political tool for the prosperity of socialist/communist society. A case of science in Poland of the second half of 1940s and in the 50s. Scientific consciousness and the diffusion of knowledge were two crucial elements, as the so called fundament base (in Marxist terminology), for a fluent social change of human minds after the World War Two in East Central Europe. People had to be transformed in to a new kind of human beings (depicted later as homo sovieticus), who might and should be deeply devoted to creating a new political system of declared liberty, equality, and brotherhood. The end of war was a positive factor in that process. Those ideas taken straight from the French revolution were however understood in a quite specific way. In relatively short time one could understand that the people are equal, but there are also those who are „more equal” than others, as in George Orwell Animal Farm. There were also those who had been condemned and excluded from the society. What was the place of science popularization in that process, and did the communist authorities succeed in creating a new, materialistic mind of the citizens? Is it possible to use science as an instrument of propaganda for political purposes. Is science - in a specific political camouflage – useful as a core for political propaganda and indoctrination? In this text I try to answer some of those questions. The society would be the battle field, and the laboratory for all those experiments. How reacted conservative, Catholic, Polish community for the requirements of the communist elites, imported mostly from the USSR? What was the final response for those new stimula and what was the result? Was the miraculous ascension to the communist paradise possible? Was it a dream or the nightmare?

Europe, Poland, Stalinism, academic life, research

Wilhelm Ostwald's American Supporters to Nobel Prize of Chemistry

Leticia dos Santos Pereira, UFBA/UEFS

The chemist Wilhelm Ostwald (1853-1932) is one of the most important characters in the history of Modern Chemistry. Connected in some way to almost all the main episodes of chemistry in the late 19th century and early 20th, Ostwald gave many contributions for Physical-Chemistry and its institutionalization and popularization among scientific community, breaking the resistance to important theories in this field. Moreover, his investigations on rates of reaction, chemical equilibrium and catalysis granted him the Nobel prize in Chemistry in 1909.

Ostwald also is recognized for his philosophical point of view and scientific approach for Physical-Chemistry problems. These characteristics were connected in some way to Energetics, an anti-mechanistic scientific program which sought to unify and reinterpret the science in terms of transformations of energy.

All of these Ostwald's successes made him a central figure in German Physical-Chemistry, attracting many young students interested, at the time, in this new research camp for Ostwald's laboratory in Leipzig University. Some of these students crossed the Atlantic to work with Ostwald: it's the case of many chemists from the United States, that later have contributed for Physical-Chemistry development in North-America.

These relations among Ostwald and the north-Americans chemists made him the first chemist to receive north-Americans nominations letters for the Nobel Prize of Chemistry, in 1905 and 1906.

These letters, written by three important chemists from the U.S. show that were not only Ostwald's scientific achievements that had been recognized for his American supporters. Contributions of other

ICHST
2017

nature were mentioned in these nominations letters, leading us to consider on the possible philosophical influence from Ostwald on American Physical-Chemistry. Therefore, in this work we will discuss the nominations letters of three North-American chemists – Theodore Richards, Arthur Noyes and James Walker – and to discuss on the extent and influence of Wilhelm Ostwald's scientific and philosophical thought in his time.

Wilhelm Ostwald; Nobel Prize; History of Chemistry

Scientific racism: some contemporary and historical perspectives

Leyla Mariane Joaquim, UFBA

Charbel Niño El-Hani, UFBA

This paper analyzes scientific discourses about race of today and links them to episodes of the past. We address scientific racism at two historical perspectives. First, we focus on a contemporary study, which highlight current reductionist fallacies. Then, we connect this study to historical episodes related to the eugenics movement in the early-twentieth century.

Throughout the centuries a great deal of scientific evidences had accumulated to support that race is not a biological reality. Today the vast majority of those involved in research on human genetics and variation would agree that biological races do not exist among human. However, racism still abounds in modern scientific discourse. The contemporary study is a literature review essay. We analyze the current scientific literature concerning race in genetics, genomics and related fields. The qualitative analysis of the literature is based on a classification of neurogenetic determinism proposed by Steven Rose. Neurogenetic determinism claims to explain everything - from violence in the streets to sexual orientation - in terms of properties of the brain or genes. These claims draw on the new genetic techniques, but reflect a much older reductionist fallacy. By comparing recent and historical approaches, we highlight reductionist fallacies that led to scientific racism and to old and new attempts to marginalize human groups and treat them as inferior.

scientific racism today past

The Formation, Dissemination and its Backgrounds of the Theory “the Climatic Aridity in Northern China and the Sands trending Southward” (1876-1949)

Liang Liu, The Institute for the History of Natural Sciences

Since the modern times, the theory "the Climatic Aridity in northern China and desertification southward" proposed by some western scholars in China aroused widespread concern and strong resonance in the country, and got spread by scholars of various professional backgrounds. Through sorting a large number of the original literature, in the form of chronology, this paper fully demonstrates the formation process and dissemination of the theory, and does as far as possible in-depth analysis on the interaction between the scholars. And then this paper makes a comprehensive explanation for the formation and communication of the theory from aspects of the geographical differences between the Occident and China, the history of learning geographical environment of China by the Occident, national conditions and upsurge of the ethos "science saves the nation" since modern times, the related conclusions by research on historical climate and environmental changes, and makes objective evaluation on the rationality.

Formation; Dissemination; Backgrounds; Climatic aridity; Sand trending southward

Naming, Knowing And Taking Position in Xviiiith Century Chemistry

Lígia Lopes Gomes, Universidade de São Paulo

Chemistry was an emerging and bustling science in the enlightenment Europe. There wasn't a sole unifying theory which could explain most of the chemical phenomena. Even the phlogiston theory could give an account of only part of it, and it was a rather flexible theory, so it might be more correct to talk about various phlogiston theories and not a single one (BENSAUDE-VINCENT and STENGERS, *A History of Chemistry*, 1996, p.44-91).

Throughout the century, however, nomenclature seems to have been a problematic issue, because it made harder for scientists to communicate properly with each other, specially in a time when so many new substances were discovered. There might be different names to the same substance, or the same name to different substances. Substances might be named a « salt » or « wine » when they effectively were not.

So, correcting such imprecise language and creating rules for naming future discoveries was a key question for chemistry. But not only, physiology had the same issue. The french philosopher Condillac, in his *Logic* (1780) stated that all science is a language well written. And a language which embeded so much confusion such as that of XVIIIth century chemistry simply needed reform.

That was not an easy issue to tackle. It wasn't just a matter of altering the names, using a language easier and clearer, which could be properly understood by anyone anywhere and which did not lead to errors. It was also about offering (and convincing others to accept) some kind of sistematization of a science which appeared radically inductive. And it was about taking position on the issue of whether the nomenclature – and classification which came along with it – did exist in nature (as Lavoisier suggests in the Preliminary discourse to *The Elements of Chemistry*) or if it was an act of the knowing mind (as proposed by Condillac in his *Logic*).

In this work we would like to address some of this issues, studying particularly the nomenclature proposed by Guyton de Morveau, Berthollet, Fourcroy and Lavoisier in 1787, contrasting with Condillac's understanding of science and language.

Chemistry, Nomenclature, XVIIIth century, Condillac, Language

The Body Medical and Social: Western Concepts and Chinese Interpretations in the Early 20th Century

Liping Bu, Alma College

Public health and modern medicine were benchmarks of the advancement of society at the turn of the 20th century, as national death rates became the indicator of a nation's progress and strength. With germ theory providing modern medicine with scientific foundation and guiding the development of preventive medicine, health professionals emphasized personal hygiene and community sanitation as ways to improve health and prevent disease. Chinese modernizers advocated scientific modern medicine as an essential element to transform traditional China into a strong modern nation. They paid special attention to the relation of medicine and society, and how medical modernization was an essential necessity to rejuvenate the Chinese nation. They anxiously urged the government to adopt modern medicine to improve public health while popularizing new health ideas to make people aware of the connections between national health and national strength. Central to their advocacy of modern medicine to strengthen China was their injection of Social Darwinian ideas of "survival of the fittest" argument, citing Western powers as the example for emulation. The circulation of medical knowledge and social theories from the West to China,

however, was not a simple process of transmission but a complex social and cultural adaptation and integration. Western concepts and ideas had to make sense in Chinese cultural and social settings. Drawing on various archival data, this paper discusses Chinese interpretations of the human body and disease in relation to national progress and strength under the influence of modern medical sciences and social theories in the early 20th century.

Medicine; public health; China; Western; modernization

The Nordic Exhibition in 1888 – analyzed as a snapshot of the international exchange of knowledge and technology

Louise Karlskov Skyggebjerg, Technical University of Denmark

The world's fairs in the 19th Century were places of knowledge exchange, comparison, and competition among nation states. On the level of the individual visitor they were opportunities of entertainment and knowledge enhancement. The 1888 Nordic Fair in Denmark was no exception. The idea was to show the progress in Nordic business and production life, and other European countries were invited to function as background for the evaluation of the state of the art in the Nordic countries.

The paper will analyze The Nordic Exhibition in 1888 as a snapshot of the international relations of Danish business life with an emphasis on the exchange of knowledge and technology. The exhibition is seen as a local spot in a global network of knowledge, technology, and goods, and it is used as a lens through which the exchange between the local and the global is analyzed.

Butter, beer, engines and decorative arts were among the things on display. In 1888, the Danish agriculture was nearly through a transformation from export of grain to export of butter and bacon. At the exhibition, this transformation was represented by a functioning dairy including another export success, the Maglekilde centrifuge. The dairy was a showcase for a Danish technology, but also an example of the practical use of the scientific knowledge of hygiene built up through the 19th Century. This knowledge was central too to another business heavily exposed at the exhibition, the Danish breweries. A new pure brewer's yeast culture from 1883 was the result of the work of Emil Christian Hansen at the brewery Carlsberg, and this yeast had spread quickly to other countries. As on many other fairs in the 19th Century, engines, electric light and industrial machinery were among the highlights. Steam engines dominated the machine hall, however, gas motors designed by Nikolaus Otto were represented in Danish produced versions too. The engines and machinery were examples of import of technology and knowledge from primarily England and Germany to the industrial late-comer Denmark.

The initiator of the exhibition was Philip Schou, head of the Royal Porcelain Factory and a promoter of decorative arts. His main thought was that Denmark, a country without coal and iron, was unfit for heavy industry and should focus on decorative arts instead. In fact, the Danish porcelain factories had a break through at the exhibition, and their products are still sold worldwide as Danish Design.

knowledge exchange; technology; network; exhibition; industrialization

The Religious Factors for the Calendars of the Qing Dynasty (1644-1911)

Lu, Dalong, University of Chinese Academy of Sciences

In the period of the Qing Dynasty (1644-1911), the four calendars had been formerly issued in succession, they are Xiyang Xinfu Lishu, Treatise on Mathematics (Astronomy and Calendrical Science) according to the Western Method, issued in the Ming (1635) as Chongzhen reign-period Treatise on

(Astronomy and) Calendrical Science, revised as the former by Johann Adam Schall von Bell (1591-1666) and the year of 1628 was selected as the epoch of the Calendar, issued in 1645, Kangxi Yongnian Lifa, The Eternal Calendar of Kangxi Emperor (1654-1722), the fourth emperor of the Qing Dynasty from 1662 to 1722, in which the astronomical parameters for 2000 years (1828-3827) had been listed, compiled by Ferdinand Verbiest (1623-1688), issued in 1669, Yuzhi Lixiang Kaocheng, Complete Studies on Astronomy and Calendar, issued in 1725, and Yuzhi Lixiang Kaocheng Houbian, The Supplement to Complete Studies on Astronomy and Calendar, had been put into use from 1742 to 1911. Introduction (lizhi) to, theories (lili) for, and mathematical principles (shuli) of calendrical sciences had been gradually interpreted in Xiyang Xinfu Lishu, Yuzhi Lixiang Kaocheng and Yuzhi Lixiang Kaocheng Houbian. Had cooperated with Chinese astronomers in pursuit of the completeness and perfection of the astronomical sciences, the Jesuits had served as the directors or deputy directors of the national observatory (Qintianjian) from 1645 to 1837, and made a great contribution to the introduction of Western sciences, especially astronomical and mathematical, into China in early Qing Dynasty, the climax occurred during the reign of Emperor Kangxi of the early and mid, and a sudden decline in his later years as the result of the rites controversy. Until the outbreak of the opium war, Western missionaries had come into China, but unlike the Jesuits, who has been assumed the role of communication between Chinese and Western cultural exchange, and the religious factors in Modern Chinese astronomy has disappeared.

mathematical principles; completeness; religious factors; calendar; the Qing Dynasty

Chemistry and Medicine in the beginning of modernity: the "baconian program" and the question of human longevity

Luciana Zaterka, Center Of Natural and Human Sciences, Federal University of ABC

Francis Bacon, in none of his Histories, was so clear about the purpose of his philosophical work - a restoration of knowledge lost since original sin through a new conception of experimental and operative science directed to the well-being of the majority - than in his instigating *Historia vitae et mortis* (1623). In this work, he discusses, through his theory of matter, the question of the duration and longevity of animals and men. In this sense, when handling a complex theory of matter, the English thinker proposes possible scenarios for the physical regeneration of man. Bacon believes that if we can properly handle the spirits that make up human bodies, we can delay the senescence of these bodies and achieve a long life. Thus he introduced the possibility, unimaginable hitherto, of man exercising dominion over nature, this empire not only practiced upon external nature, but also on himself, indeed, on his own body. In this way, Bacon anticipated some of the fundamental ideas that would lead some members of the Royal Society to test experiments on blood transfusions. Robert Boyle, for example, researched the nature and property of blood throughout all his work. Among the numerous texts that the chemist deals with this question we find *Memoirs for the Natural History of Human Blood* (1684). Boyle, following the "baconian program" of knowledge, wrote a natural history of blood. And so he introduced an important place for the study of chemical substances and their relationship with the human body. The chemical perspective is, in this sense, fundamental, because like Bacon, Boyle believes that in order to achieve a good intervention in the restoration of health, the body should not be seen as fundamentally different from the inorganic scope; all bodies are subject to the same natural laws and therefore we can and must - as ministers - intervene both in nature and in the human body. In this way, Boyle opened the possibilities for more effective studies on the nature of blood and the possibility of experiments through transfusion. In this way, he adopts a strongly experimental bias, approaches the human body as a chemical laboratory, and aims to increase knowledge about physiological operations as chemical reactions. From here the doors opened to the modern dream of introducing increasingly numerous and effective techniques of "rejuvenating" or "restoring" individuals.

Intersections between the social sciences and biology: the 'organic' concept in the urban theory of Patrick Geddes and Lewis Mumford

Ludmilla Magalhães Bueno, Universidade Estadual de Campinas - Unicamp

In urban studies it is common to find works that focus on the relationship between urban planning and the medical discourse and the engineers who proposed interventions in urban space through sanitary and utilitarian interpretations. In philosophy and sociology of the turn of the nineteenth century to the twentieth century the discourses on the crisis of modernity also interpreted the city as an example of the monstrosity and disease of the times. However, two authors in special dedicated to think the city both in its historical and theoretical aspects as in practical interventions, took from biology the basis to think the city without being led by a pessimism or merely technique analysis. Understanding cities as living organisms, with cycles of development in time and with an internal functioning that needs harmony, they criticized the process of megalopolization and propose solutions for the modern individual to reconnect collectivity.

The biologist Patrick Geddes dedicated himself to studying urbanism from an evolutionary point of view, having his theory presented in his main work 'Cities in Evolution', published in 1915. Later, Lewis Mumford publishes the book 'Culture of Cities' in 1938, that can be considered a continuing disciple of Patrick Geddes' theories in urban studies, enhancing the studies in their cultural and historical dimensions. Both authors took some concepts from biology conceptions to understand the social and historical reality of cities, especially the idea of "organic", to think cities in their time process and inner workings. They also preconized the discussions of nature in urban space and urban environmentalism. This presentation intends to discuss the relations between biology and social thought in these two theorists of the history of the cities, distinguishes them from the sanitary and technical medical discourse, that also mobilized the idea of organism, but in its dimension of the disease, and finally to point out some contributions of his proposals for the field of urban history and urbanism, as well possible criticisms and revisionisms in his theories.

urban history; biology; Patrick Geddes; Lewis Mumford; organic concept

Medical profession in local practice through the early modern Portuguese Empire (1498-1604)

Luís Ribeiro Gonçalves, PHIUDHist / CIDEHUS-UÉ / CH-UL

When Portuguese reached the India Ocean, they opened new transoceanic trade routes for sources of spices and powerful drugs, creating opportunities for new transactions between different medical cultures. Throughout the sixteenth century, medical practitioners like Garcia de Orta or Tomé Pires became famous with the discovery of new remedies and new local therapeutic practices. For modern historiography, they were seen as important figures in the rise of the Portuguese medicine in sixteenth century. Only in recent years, this image is being reframed, placing these doctors within the socio-cultural context and their articulation within the European science, and creating new perspectives for their medical careers in the Portuguese Empire.

Alongside these doctors, there were many others doctors, surgeons, apothicaires or bonne-setters worked in Portuguese fortresses or in local hospitals, taking care of the populations, whether they were military or municipal officers, indigenous or immigrants, slave or free. From Morocco to India, the presence of this practitioners was the best answer given to the challenges posed by injury and

disease on the presence of the Portuguese overseas communities. Nevertheless, most of what we know about these medical practitioners is based on the life of famous doctors, whereas most of the others remain frequently absent. For many cases, not only there is few information about their careers, but also, little is known about the way they dealt with these contexts of interchanging medicine traditions and, simultaneously, of disease and assistance. Looking towards a better understanding of this contexts, we'll use a prosopographic method, aiming to:

- Analyse the medical training, forms of licencing and their careers in the local assistance network, aiming to understand which was their medical cultural background;
 - Examine how they received local knowledge and in which networks they relied on, as we try to recognize strategies of acquisition and control of local medical practices;
 - Observe how these medical practices dealt with the local needs for assistance and healthcare local, in articulation with other care givers like the Jesuits, in the sixteenth century missionaries contexts.
- This paper pretends to raise new questions about the medical practices in sixteenth century Portugal, we will address for the Empire some of the questions we are researching for our PHD about the Portuguese municipal system of health officials.

Medical municipal system; Local medical practice; Professionalization

The study of botany and the education of people: some considerations about Frederico Carlos Hoehne

Luna Abrano Bocchi, Universidade de São Paulo
Ermelinda Moutinho Patata, Universidade de São Paulo

This work addresses Frederico Carlos Hoehne's work in some institutions in São Paulo during the first half of the 20th century. He built his professional trajectory in recognized institutions, including the Museu Nacional (RJ), Instituto Butantã, Museu Paulista and Jardim Botânico, these last three located in the city of São Paulo. He also participated in the creation of the Instituto de Botânica and, at the same time, was recognized by his experience in scientific expeditions, and also for his performance as orchidophile and researcher, having several works published in this field.

Covering the years Hoehne worked at the Instituto Butantã, Museu Paulista and at the Jardim Botânico, we took into consideration the educational proposals that he established in accordance with the practices of botany. On the assumption that biological sciences would enable progress, and also moral and intelectual advancement of the nation, Hoehne granted great importance to the dissemination of scientific knowledge and to the promotion of the interest in the studies of this field.

From theoretical references of the History of Science and the History of Education, we propose an articulation between these two fields of knowledge to examine his professional trajectory, understanding that there was an intrinsic relation between the scientific practices and the educational proposals. The examination of social practices involves looking at botany as a cultural production and, as such, considered in its entanglements with the various subjects, institutions and actions constituted throughout its history. Concepts, practices and representations are seen in relation to education and, thus, coupled with the activities of dissemination, expositions and preparation of teaching materials, among others.

Hoehne's publications are privileged sources for understanding the principles that guided his work and the way he conceived the studies of botany. The Works that will be examined, primarily, are the *Album da Secção de Botanica do Museu Paulista* (1925) and the *Resenha histórica para a Comemoração do vigésimo aniversário da Secção de Botanica e Agronomia* (1937), texts that show the changes undergone by the Secção de Botanica and the entities subordinate to it. Besides the bibliographic research, this research comprises the examination of iconographic sources and objects that constitute the material culture.

botany, education, Frederico Carlos Hoehne

“En la Argentina, todos vuelan”: Aviation and Progress in Juan Perón’s “New Argentina”, 1943-1955

Marc Alsina, Johns Hopkins University

This paper investigates the culture and politics surrounding aviation in mid-twentieth century Argentina. The nationalist government of Juan Domingo Perón, the defining political figure of modern Argentina, vigorously promoted military and civil aviation. Perón’s Justicialist Party sought to instill “aeronautical consciousness” [conciencia aeronáutica] in the minds of people to protect the nation and modernize its economy and culture. This effort was a key facet of Perón’s political and industrial project, which promised to reforge the nation into the “New Argentina”. Large-scale aviation around the world has always relied on government support, and is thus reflective of a government’s interests, ideological foundations, and structures. I demonstrate how Perón’s political rhetoric and needs shaped the Argentine aviation program while highlighting the roles of a small set of aviation boosters who wedded themselves to Perón’s political movement to bring their aeronautical dreams to fruition. This involves a close analysis of government aviation policy, its justifications, and the Peronist use of aviation in its propaganda. I focus on the ministry created by Perón and his supporters in 1945, the Secretaría de Aeronáutica, which coordinated and funded the rapid expansion of the nation’s aviation industry until the Peronists’ ousting in a coup d’état in 1955.

aviation; Argentina; Juan Perón; Peronism; progress

Development of the notion of number line

Marcello Amadeo, UERJ

This work has the goal to discuss the origins of the number line notion during the eighteenth century and the early nineteenth century based on the analysis of mathematics textbooks (both at the secondary level and the level of higher education), sources revealing of research and mathematical encyclopedias. We make some remarks about the differences between this notion in the context of that period and this notion in our present context, seeking to establish that it is a historical reading of the development of a mathematical notion and therefore should respect the practices of the time in which they were established. We seek original sources of French and German mathematics, which stand out in this period: the one as the major mathematical community and the other as an emerging one. Our main result is that the notion of number line, as we understand it as valid today, became established only in the first half of the nineteenth century, in the context of mathematics teaching at secondary level.

History of mathematics; history of analytical geometry; number line

The Genesis of the "Principle of Insufficient Reason" in Leibnizian Thought and its Implications in the Principle of Maximum Entropy

Marcelo Mattos Antunes, Seduc

Alexandre Lyra de Oliveira, Observatório do Valongo e HCTE / UFRJ

Carlos Benevenuto Guisard Koehler, HCTE / UFRJ

In this work we investigate in Leibniz's work the foundations of his philosophy that are pertinent to the Principle of Maximum Entropy of Jaynes.

Starting from C. Shannon's concept of entropy exposed in his work "Mathematical Theory of Communication" (Shannon, Bell System Tech., 379.623 (1948)) We note that this concept it has the same functional form as the Boltzmann-Gibbs statistical entropy. This is not surprising, since Shannon claimed he was inspired from the analysis of Boltzmann-Gibbs theory.

E.T.Jaynes (Phys. Rev. 106, 620 (1957) emphasized the historical roots of the so-called "Principle of Insufficient Reason", which he attributed to Laplace, considering the principle of maximum entropy as an extension of the "Principle of Insufficient Reason". However, our study indicates that this principle has its roots in the Leibnizian philosophy, when Laplace states in the introduction to his book "Essai Philosophique sur les Probabilités" (pp. 6, 7, (1814) that Leibniz's Principle of Sufficient Reason also Applies to events whose causes can not be known to us, due to the limits of our knowledge. Leibniz states that "Nothing happens, without there being a sufficient reason to be so, and not otherwise, although many times these reasons can not be known to us." (La Monadologie, p. 607, Philosophischen Schriften, vol. VI, Gerhardt, (1885).

We consider Laplace's reference to Leibniz in his "Essai Philosophique sur les Probabilités", a convincing proof that allows us to affirm that the "principle of insufficient reason" predates Laplace and can be found, for example, in Leibniz's philosophy, in his manuscripts on probabilities (Estime des Apparences, M. Parmentier, 1995). In his book "Nouveaux Essais sur L'Entendement Humain" (Philosophischen Schriften, p.39, vol. V, Gerhardt (1882) and also in several correspondence of Leibniz with Jacques Bernoulli (Leibnizens Mathematische Schriften, 1850-1863).

Finally, we recall that in a letter that Leibniz sent to Queen Sophia Charlotte in 1702, he said: "In some cases the natural light of reason is insufficient to inform us the details of things and our experiences are very limited so that we can glimpse your laws. " (Leibniz, Philosophical Essays, Garbier (1989).

Entropy; Principle of Maximum Entropy; Principle of Insufficient Reason; Principle of Sufficient Reason

Indigenous knowledge about the sky through the european chronicles of sixteenth-century: thoughts about their inclusion in the basic education system

Márcia Helena Alvim, Universidade Federal do ABC

This study forms part of ongoing research that seeks to analyse the inclusion of the history of indigenous knowledge about the sky in the Brazilian basic education curriculum. We will first analyse how indigenous knowledge about the sky was mapped by European chroniclers in the the sixteenth century, referring to texts by Jean de Lery, Claude D'Abeville and Gabriel Soares de Souza. It is essential to conduct researches into the knowledge of these European authors in order to map this knowledge properly and to understand the process of constructing our cultural identity, especially when we reflect on the actions that led to indigenous history being silenced, both from a cultural and educational perspective. The research will then develop ongoing pedagogical activities for basic education teachers and will attempt to analyse the effectiveness of promoting this topic in the classroom.

The study engages with different theoretical frameworks, in particular: Indigenous History (CUNHA, 1990, 1992; CAVALCANTE, 2011; BITTENCOURT, 1994; MONTEIRO, 1995; GOULARTE, 2013; GRUZINSKI, 2001, 2003) and multicultural education (FLEURI, 2002; BAVARESCO, 2016; PERRELLI, 2008; BOAVENTURA, 2006, 2010) from the perspective of the Cultural History of Science (ALVIM, 2014; PIMENTEL, 2010, FALCÓN, 2006). There have been numerous initiatives seeking to preserve the value of indigenous culture and history since the late twentieth century. One of these was the enactment of Law 11,645, which promotes research and teaching on indigenous history. By valuing indigenous knowledge and breaking away from the more traditional Eurocentric and evolutionary perspective of history that is taught in schools, this research will therefore be making an active contribution to this legislation. We will thus seek to present indigenous people, their practices and knowledge bases as historical subjects, encouraging new thinking about them in basic education.

Some of the expected outcomes of this project include: an analysis of indigenous societies' knowledge of the sky reported in documentary sources, a reflection on how colonialism forged a discourse on indigenous knowledge and culture, analysis on including indigenous knowledge within the school curriculum and promoting a teaching perspective that presents this viewpoint.

Indigenous Knowledge, History of Science, XVI century, Brazilian Chronicles

The Influence of Immanuel Kant's "Physische Geographie" during Institutionalization of German Geography in the 19th Century

Marco de Souza Paes, Universität Hamburg

In the history of geographic thought, there is a strong and still unsolved debate concerning the considerable similarities between the basic ideas on geography between Kant and Alexander von Humboldt. Hartshorne (1978) argues that the definition, as used by Kant since 1775, was first published in 1802 by his student T.F. Rink at "Physical Geography". Humboldt's basic reflections appear for the first time in a Latin publication of 1793, and later at "Kosmos" of 1845. Nevertheless, most studies about Kant, geography and their relation have looked for the same question: "What does geography mean for Kant and what does Kant mean for geography" e.g. (MAY, 1970, FRITSCHER 1984, GERDLAND, 1902). To provide these evidence, I investigate e.g. the work of authors such as Konrad Mannert (1756-1834). According to F. Lotschge (1968), Konrad Mannert was a German historian and geographer at the University of Altdorf. Although he was a professor of history and oriental languages, he took the scientific management of the Homännische Maps office in Nuremberg in 1803. Later in 1807 he was professor of history and geography at the Landshut University as well. Particularly remarkable was his main work "Geography of the Greeks and Romans", Nuremberg 1788-1825 published in 14 volumes. Mannert practiced teaching as did Kant or Karl Ritter. Moreover will be investigated here whether his works contained also elements of Kant's classification of geography as a science. In the following Chapter I am concerned with two questions: How geography and history behaved in the scientific practice in the 19th century? How they were methodically separated?

Physische Geographie, Immanuel Kant, Institutionalization

The history of a Betatron and the history of the Institute of Physics of University of São Paulo and of Physics in Brazil

Maria del Carmen Hermida Martinez Ruiz, CPC/USP

In 2004, Estação Ciência, a science centre of University of São Paulo, inaugurated an exhibition on Nuclear Physics that included a Betatron, a Geiger detector and a cosmic ray telescope. When presenting the exhibition to the explainers, Professor Ernst W. Hamburger, responsible for the exhibition, spoke passionately about the link between research on cosmic radiation and later on particle accelerators, with the formation of the Institute of Physics of USP and the history of physics in Brazil. Since then, at Estação Ciência, the Bétatron began to play the role of a museum object to explore not only the operating principle of particle accelerators, but mainly the history of researchers and scientists and the history of physics in Brazil. Research in publications and testimonies that were carried on with the purpose of telling the story of the Bétatron of the IFUSP made clear that it is not possible to separate them taking us back to the creation University of São Paulo in 1934 and the coming of Professor Gleb Wataghin. He introduced researches on cosmic rays involving both theoretical and experimental questions such as the development of apparatus. Professor Giuseppe

Occhialini was invited to assist in the research. The first group of assistants that included Mario Schenberg, Marcello Damy de Souza Santos, Cesare Mansueto Giulio Lattes, Oscar Sala, Abraão de Moraes, Paulus Aulus Pompéia, Yolanda Monteaux and Walter Schutzer and their disciples José Leite Lopes, Jaime Tiomno and José Goldemberg created and developed new research centers. The prestige that the group conquered with cosmic ray research allowed the formation of disciples and then the study of particle accelerators that emerged as an alternative to cosmic ray research. Marcelo Damy brought the Bétatron, recommended by Compton, and designed a magnetic spectrometer of pairs for the measure of the Bremsstrahlung spectrum. Oscar Sala studied electrostatic accelerators and their possible applications. He returned with the design of a Van de Graaff type accelerator, involved national entrepreneurs in the development of equipments and had the collaboration of the professors Ernst W. Hamburger and H. M. Nussensveig in its construction. The two accelerators opened a new perspective of works on Nuclear Physics in São Paulo that enabled technical developments and a great number of original scientific researches. In the late 1960s these accelerators were replaced by Linear Accelerator and Pelletron.

particle accelerators, history of Nuclear Physics in Brazil. history of Institute of Physics of University of São Paulo

The history of chemistry in Pará: The trajectory study started by the creation of the pharmacy school (1904-1921)

Maria Dulcimar de Brito Silva, Universidade do Estado do Pará

Gysele Maria Moraes Costa, UEPA

André Silva dos Reis, UEPA

This research aimed to recover the origins of the Teaching Chemistry in Pará in order to create new sources of research in this field, contributing to the studies in History of Chemistry in Pará from the creation of the Pharmacy School. The beginning of the 20th century was still marked by the conflict of folk medicine and modern medicine. This fact culminated, during the First Republic, in policies concerned with life's quality and scientific interests. The creation proposal to Pará's Pharmacy School rose with the spread of the Pará's Medical-Pharmaceutical Association, conceived in 1897 by the Governor José Paes de Carvalho to the state's progress, to deal with social, scientific and moral issues with aspiration to provide public health services (NASCIMENTO, 2015). The main goal in the school creation project was to defeat diseases that ravaged the Amazon and the legitimacy of the School Degree. The Pharmacy School was created in 1904 in Belém do Pará working in the library of the State Sanitary Service. The high school course was composed by three teachers from the health institution itself and the course was completed in two years. The subjects related to teaching chemistry in the first and second year were: Medical Chemistry and Pharmacology (practical and chemical pharmacy). (SILVA, 2003). After six working months, the establishment was equated with the official schools in Brazil, needing to be reorganized according to the Organic Law of Higher and Basic Education. This law determined the exercise of regulated professions, certified the school degrees and full freedom in the didactic and administrative point of view. With this, the course duration changes to three years. In chemistry's spot were taught: Mineral Chemistry in the first year; Organic and Analytical Chemistry in the second year; and Industrial, Toxicological, Bromatological Chemistry and Pharmacology in the third year. In order to set up the perfect regularity of the course, some other adaptations were necessary, such as a federal inspector at school, taxes to emit degrees and a new way of teaching in 1921. In this time, the subjects were divided in six sessions, which the second and fifth sessions were occupied by chemistry, being; Mineral, Organic and Industrial Chemistry in the second and Analytical chemistry in the fifth session (SILVA, 2003). Thus, the Teaching Chemistry in Pará's Pharmacy School added to the History of Science research.

History of Chemistry; School of Pharmacy; Chemistry Teaching

Contributions for a History of Plastics in Portugal

Maria Elvira Callapez, CIUHCT/FCUL

This paper aims to present an interdisciplinary project on aspects of the history of plastics in Portugal, by basing itself on technical-scientific, industrial, social-historical studies, as well as studies pertaining to the history of science and technology and material culture.

The project intends to perform a full history of plastics, in order to bring to light : the techno-scientific aspects of plastics (and its communication to the general public); the need to preserve plastic objects; the role of plastics in the development of the industrial design, not just as corporate strategy but also in everyday life; the relationship of the plastic industry with their bodies (local workers and elite) and other industries (electrical and glass); energy and environmental issues related to plastics. We plan to set up a museum, to carry out studies on conservation, historical, technological and scientific research of plastics.

One of the purposes of this project is to study the impact of plastics in the Portuguese society, since its arrival in the mid-1930's, through Bakelite, the first true plastic, in an agricultural country, without chemical research and technology nor an industrial tradition, in contrast with the more advanced industrial nations, where plastic had already assumed its position as an emblem of modernity.

The plastics industry has come to occupy a prominent place in the economies of industrialized countries since the inter-war period until the present day. The paper will reflect on how this development should be put on display in museums with important collections of plastics objects. Starting with Baquelite Liz, a company located in Leiria- centre of Portugal- the birthplace of the plastics manufacturing industry, that has worked in plastics since 1940, our intent is to carry out tasks such as the surveying and cataloguing of its estate, respective manufacturing methods, in addition to its impact on the social and cultural life of the region, and expand this work to other similar businesses. On the other hand, special attention will be devoted to Portuguese collections of plastic materials.

History of Plastics; Conservation of Plastics; Entrepreneurship; Material Culture; Museum of Plastics

Turn-of-the century medical visual culture: from chronophotography to early cinema

Maria Estela Jardim, Centre for the Philosophy of Sciences of the University of Lisbon, Portugal
Nadia Vera Jardim, Independent Scholar

The French physician and physiologist Étienne-Jules Marey(1830-1904) concentrated his study of the movement of human and animal bodies using graphing instruments; his results were published in the Graphic Method (1878). Later in 1885 he began recording the movements of pathological bodies through chronophotography, identifying biological functions as mechanical phenomena, a concept already embodied in the work of German physicists, among them Carl Ludwig and Emil Reymond. After 1888 Marey directed 400 films using the cellulose nitrate support for certain specific studies concerning the human body's movements.

From 1897 several physicians started using the cinematograph or its early precursor the chronophotographic camera as a useful tool for diagnosis, research and teaching. In March 1897, the Scottish medical doctor John MacIntyre directed a radiocinematographic film, combining the two techniques (cinema and X-rays), projecting on the screen films of patients suffering from neurological diseases (Ramsey, History of Photography, 7,314(1985). In 1891, Marey was once more the pioneer of microchronophotography, combining a solar microscope and a chronophotographic camera; however microcinematography took some time to be established as a medical media. One of the first

scientists to produce a microcinematographic film in 1907 was Julius Ries a Swiss biologist who worked at the Marey Institute and published his research in 1909 (Ries, Arch. Mikrosk. Anat. Entwickl. 74, 1–29 (1909).

Most of the early medical cinema produced was also used in scientific meetings. It was the case of the French surgeon Eugène-Louis Doyen (1859-1916) who was one of the first to direct films showing him in the operating theater. These films were projected in scientific meetings such as the Lisbon's International Medicine and Surgery Congress held in 1906 and were meant to illustrate his surgical techniques. Some of these films were recently identified and restored at the Cinemateca Portuguesa (Baptista, J. of Film Preservation, 70, 42-50 (2005). In Portugal the Nobelist neurologist Egas Moniz (1874-1955), also used the cinematograph to measure the time-lapse between contraction movements produced by the myoclonie disease. He published his results in 1913 at the Nouvelle Iconographie de la Salpêtrière. In this paper we will examine the transition from static chronophotography to the time-based early films and the role they played in medicine and in the medical community.

cinema; chronophotography; history of medicine

Female representation in medicine through the National Academy of Medicine

Maria Gabriela Evangelista Soares da Silva, Universidade Federal do Rio de Janeiro
Nadja Paraense dos Santos, Universidade Federal do Rio de Janeiro

Women, before the introduction of medical courses, were already practicing various medical practices, which would later be incorporated into medical science, such as childbirth. The midwife is considered to be the oldest profession in the world and the first person to have practiced medicine. However, the creation of medical courses also leads to the appropriation of the midwives techniques by doctors and the scientific knowledge overlaps the popular. In this scenario, the work of midwives is seen as inferior and disqualified from academic medicine. In Brazil, this cultural change occurs with the arrival of the Portuguese royal family and the creation of the first medical schools in Bahia and Rio de Janeiro in 1808. The emergence of these schools contributed to the consolidation of scientific medical knowledge. Thus, medical schools besides depreciating the profession of midwives, who were women; Also prevented them from acquiring the scientific knowledge of medicine, since access to higher education was prohibited until 1879. Only in 1887 the first woman enter the medical course at the University of Salvador; Making the history of academic medicine for women begin only at the end of the 20th century. Over the centuries, the number of women attending medicine has increased significantly, but, men are still a majority in the exercise of the profession. In this scenario, the present article analyzes the feminine representation in medicine through the National Academy of Medicine, which was created in 1829 and continues acting in the Brazilian scenario as a reference in the study, discussion and development of the practices of medicine, surgery, public health and Science. The research identified that the first woman to join the Academy was a midwife in 1871 and for five decades she was the only woman admitted as membership in that institution. The others were named successively in 1926, 1942, 1971, 1980, 1985, 1995, 1996, 2004, 2012 and 2014. And now, after 187 years, the structure of the Academy is composed of only 5 women among the titular members. In addition, they have never had a woman as president or emeritus member. This diagnosis shows the inequality between men and women and encourages us to think of policies that can reduce the barriers that prevent the insertion of women, contributing to the increase of their representation within this scientific institution.

Women; Medical Science; National academy of medicine; Inequality

Science, travel and myth: the study of the Brazilian scientific field in the early twentieth century from reports of travel scientists of the Rondon Commission

Mariáh dos Santos Martins, UFRJ

This work aims to understand the Brazilian scientific field prior to the consolidation of a university system, still in the early 20th century from the study of the trajectory of two Brazilian scientists who worked in important moments and scientific spaces during that period focusing on the analysis of specific travel reports. Edgard Roquette-Pinto, doctor and anthropologist, and Alípio de Miranda Ribeiro, zoologist, worked at the National Museum, the first scientific institution in the country, participated actively in the Rondon Commission (Commission of Strategic and Telegraph Lines from Mato Grosso to Amazon), and , along with other scientists, founded the Brazilian Society of Sciences in 1916. This work draws the characteristics of scientific knowledge production in Brazil of the early 20th century, as well as its application to social reality. Given the importance of the Rondon Commission, which provided intense experiences to several Brazilian scientists, here will be prioritized the relationship developed between these scientists and the Commission. Starting from the analysis of the production and the travel report of both scientists, we point out some aspects that were in vogue in the constitution of science and scientists in Brazil, such as the importance of the experience of a trip that is justified by the field work, the development of a travel journal, and the existing symbolic aspects that makes references to the mythological hero journey. At the end of work we plan to obtain an overview of Brazilian science in the early decades of the 20th century, primarily from its ideal and representation that was influenced by a scientific tradition of the 19th century. In this mister, we also intend to get a more specific look at the possible trajectories of scientists at that time in the country, represented by the zoologist and anthropologist studied, which, despite its meetings, followed opposite paths. This work, through a specific look, intended to contribute to reveal a Brazil of the first half of the 20th century.

Travel reports; scientists; Rondon Commission; Miranda Ribeiro, Roquette-Pinto

Contribution of Croatian scientist Faustus Verantius to the development of technical thought

Marijana Boric, Croatian Academy of Sciences and Arts, The Institute for the History and Philosophy of Science

Vanja Flegar, Croatian Academy of Sciences and Arts

In it's calendar of important events UNESCO has indicated the 400th anniversary of the publication of the book *Machinae novae* (Venice, 1615/1616) which was written by Faustus Verantius (1551 – 1617), as one of the main works of the Renaissance and the first technical manual in Croatia. Faust Verantius was a prominent Croatian scientist whose importance goes beyond the limitations of his period. He lived and worked at the turn of the 16th to the 17th century and is an example of a successful renaissance type of man – homo universalis.

Faustus Verantius was a humanist, inventor, engineer, lexicographer and politician. He was active in the elite scientific and political circles of Europe of that time. He was one of the most influential people in the service of Rudof II. Habsburg, Holy Roman Emperor and King of the Croatian-Hungarian kingdom. Faustus work outlives its time. His two most important works are: a technical manual *Machinae novae* (Venice, 1615/1616) and his five-language dictionary *Dictionarium quinque nobilissimarum Europae linguarum, Latinae, Italicae, Germanicae, Dalmatiae et Ungaricae* (Venice, 1595), which is the first vocabulary of Croatian and Hungarian language in the history of lexicography.

Because of the universality of Faustus and his areas of interest the historians of science compare him with Leonardo da Vinci. In this paper special focus will be placed on the characteristics, structure and

content of the work *Machinae novae* with which Vrančić achieved worldwide fame. The work will be evaluated in the aspect of Western European Renaissance scientific and technical tradition. A special accent will be placed on Vrančić's contribution to the invention of the parachute - project homo volans. Along with the homo volans project other outstanding technical ideas are presented in *Machinae novae*, and will also be interpreted in our presentation. These projects transcended the limitations of time, which is shown by their use in the present.

Faustus Verantius; Machinae novae; Renaissance; developement of technical thought; parachute

A double genesis: The sambaquis and the archaeology in Brazil in the 19th century

Marília Oliveira Calazans, Prefecture of Cubatao

Some aspects of the history of the archaeological research in the nineteenth century in sambaquis (shell mounds) of Brazil will be discussed in this presentation. We consider this a double genesis: of archaeology as a science and of sambaquis as a scientific fact. We seek to establish a dialogue between the archaeology practiced in Brazil and the great scientific paradigms of the period, through the published documentation in the main Brazilian scientific journals that were outstanding during the period; and sources of nineteenth-century science institutions files.

As a result, we see the confluence of the archaeological research on the sambaquis in Brazil with the assumptions of world science as much as with an political imperial project, and with the lime industry (which used the milled and burnt shells from the sambaquis to produce the lime). The sambaquis unleashed an intellectual debate which covered archaeological and anthropological theories, confirmed geology thesis on environmental changes of the Earth and conformed thesis about the racial inferiority of Brazilian natives. This revealed a scientific panorama much more complex than a mere debate between artificiality and naturalism, appointed by archaeologists and historians of archaeology of later centuries.

sambaquis (shell mounds); history of science; Brazilian Archaeology; 19th century; lime factory

Historical review of contraceptive methods, chronological evolution from new technologies and associations with different types of diseases

Marina Vieira de Faria, Universidade Fundação Oswaldo Aranha
Arthur Ferreira Resende Delfin, Universidade Federal de Minas Gerais

The first contraceptive methods used by the population were based on plants, seeds and coitus interruptus. The condoms used were made from the bladder and intestines of animals and also protected against sexually transmitted diseases. Its quality has progressively improved, until nowadays, condoms are produced in several sizes and its material is further perfected (latex) (Gir et.

According to Pedro, 2003, in Brazil, as well as in the third world countries, the dissemination of modern contraceptive methods was part of international policies aimed at population reduction. Different from what happened with women from European countries, whose natalist policies had acquired a lot of force after the world wars. So while in places like France the pill was released for consumption in 1967 in Brazil, the contraceptive pill and IUD trade began in 1962. The first experiments on women, made by doctors Gregory Pincus and John Rock in 1956, Already had side effects such as nausea, headache and dizziness. The aim of this study was to evaluate the evolution of methods and diseases related to the chronic use of contraceptive drugs, such as polycystic ovarian syndrome, infertility and cancer, which may alter the functioning of the thyroid gland.

The LAGLOBAL Project: Remapping the Global History of Knowledge

Mark Thurner, University of London

LAGLOBAL is a transatlantic research network funded by the Leverhulme Trust and linking eight institutions of advanced research based in Europe and the Americas, each engaged in advancing scholarship on 'border-crossing knowledge practices' pioneered in the Iberian world and Latin America, specifically. The objects of study are a key set of identified knowledge practices (historical, anthropological, geographical, natural, medicinal) that typically trespassed or 'crossed' the scholastic, theological, disciplinary, and methodological boundaries that were more likely to be observed in early modern and modern Peninsular and European universities and academies, in effect making an uneasy and unsure virtue of an academic vice but also anticipating by several centuries more current concerns with interdisciplinary work in the humanities and sciences.

In the Iberian Indies parts of which became modern Latin America, the relative scarcity of traditional historical sources deemed indispensable in Western Europe would give rise to fruitful empirical collaborations among chroniclers, theologians, antiquarians, collectors, cosmographers, natural philosophers, and early ethnologists. This same scarcity stimulated collecting and expeditions, while difficult conditions of storage and transport led many collectors and patrons to 'preserve' specimens in drawings, paper museums, encyclopaedic maps, and books, thereby integrating collecting and display practices with the empirical demands and aesthetics of knowledge and empire, and increasing transoceanic traffic in papers, charts, and books. Similar developments characterized investigations of nature and the collecting of materia medica. In turn, the perceived armchair quality of Old World theory found its counter-discourse in 'Indian,' 'Creole' and 'Mestizo' critique, stimulating more traffic. Although rarely recognized today, this New World critique of Old World theory circulated widely, and was consumed not only in Europe but in Asia and Africa as well.

In summary, LAGLOBAL builds upon recent advances in the global history of knowledge and carries those advances forward, via local and area studies expertise, toward new horizons, thereby offering a working model for how to bridge the local, the regional, and the global. This presentation will describe the ongoing work of the network, and it will anticipate the contents of a workshop to be hosted by LAGLOBAL partner FIOCRUZ on August 2-5, 2017 in Rio de Janeiro.

Latin America; History of Knowledge; Historiography; Anthropology; Natural Sciences

The Machinanthropos and his machines in the confluences of Edgar Morin and Álvaro Vieira Pinto

Matheus Henrique da Mota Ferreira, Universidade Federal do Rio de Janeiro

This work has mainly an exploratory disposition, as it does not intend to exhaust such a potentially rich discussion which requires deeper researches in a wide area of the scientific-philosophical spectrum. In it, I intend to focus on two authors which were contemporaneous (of the same time), but not coetaneous (of the same historical stage), to use a common expression in Álvaro Vieira Pinto's lexicon. A Frenchman, the son of Sephardic Jewish immigrants, though an atheist, he declared himself a neo-Marrano. The other, a Brazilian, son of a middle-class family descendant of Portuguese immigrants in the ex-colony of the expatriate Marranos, perhaps himself a neo-Marrano as well. Beyond this questionable resemblance, I intend to show that their thoughts converge to a complex plot in their understanding and explanation of the man, to which I refer in the title as the

Machinanthropos, the machine-man, to Morin this man is in a long lineage of machines. This man is a machinating machine that produces itself in its praxis and produces other machines at the end of this lineage, which are much less in an existential sense than its creators. The conceptions of these two writers on man and machine will serve to beacon and guide this discussion, in which I intend to show that it is no coincidence that the thoughts of these coetaneously and geographically separated authors converge to such similar questionings and questions. This happens since their trajectories are marked, even if differently, by the same three great movements of scientific-philosophical character: Marxism (historical-dialectical materialism, scientific socialism); Existentialism (phenomenology, philosophy of existence); and Cybernetics (systems theory, control science).

Man; Machine; Cybernetics; Existentialism; Marxism

Du probable clinique à la certitude technologique: une histoire épistémologique des probabilités en médecine

Mathieu Corteel, Paris-Descartes (Paris V) - Collège international de philosophie (CIPH) - Université Paris-Sorbonne (Paris IV)

Dès le début du XIXe siècle on voit émerger au sein de l'école de médecine de Paris un débat majeur qui mobilisera toutes les grandes figures de l'époque sur la question de l'utilisation du calcul de probabilités pour l'ajustement de la pratique thérapeutique et la structuration du pathologique dans le savoir médical. Les questionnements épistémologiques qui travaillent encore aujourd'hui la médecine autour des probabilités étaient lancés: peut-on à partir de l'homogénéité du nombre penser l'hétérogénéité de la maladie ? La singularité du patient comprise sous fond de population n'est-elle pas compromise par la masse des données ? A l'issue du débat de 1837 qui eut lieu à l'Académie de médecine, le « numérisme » fut relégué au statut de monstruosité théorique face à la norme médicale. Si bien que durant tout le XIXe siècle, les probabilités furent discréditées et écartées de l'étude du pathologique. Que ce soit dans le positivisme d'Auguste Comte, dans la médecine expérimentale de Claude Bernard ou dans la microbiologie de Louis Pasteur, la méthode numérique était rejetée catégoriquement. Il fallut attendre le XXe siècle pour voir s'élever en grandeur les probabilités dans la positivité du savoir médical. Les protocoles de recherche sous la forme de RCTs (Random control trials) permirent entre autres cet essor. L'épidémiologie clinique qui en naquit provoqua un déplacement d'échelle: la singularité du patient apparut dès lors par contraste à la norme populationnelle. La localisation pathologique s'explique depuis par une globalisation des données de la recherche (Evidence based medicine). Plus généralement, une ontologie qui établit l'homme en continuité avec la machine semble avoir modélisée le corps, la maladie et la cognition sous la forme des probabilités numériques. La génétique permit en ce sens de formaliser le potentiel pathologique dans la multiplicité héréditaire, quant aux sciences cognitives, elles produisaient des simulations du raisonnement médical sous la forme de systèmes d'aide à la décision médicale (SADM). Les récents développement du big data nous confortent dans l'idée d'un changement de cadre théorique provoqué par la technologie numérique. En ce sens, l'épistémè qui cadre l'ensemble de la discursivité médicale n'est-elle pas devenue computationnelle ? Le déplacement ainsi produit par la technologie n'inverse-t-il pas la positivité médicale en faisant du probable une vérité ?

Histoire de la médecine, épistémologie, Foucault, big data, probabilités

Uranium Diplomacy in South America: Geoscience and Geopolitics in the Cold War

Matthew Adamson, McDaniel College

Uranium research and acquisition have been crucial elements of nuclear program development and geopolitical strategy from the origins of the Cold War to the present. South America has been one arena where this has been visible, beginning with American and British efforts at the end of the Second World War to assert control of Brazilian uranium supplies. The Anglo-Americans were not alone. Like several other European countries, France developed an independent atomic program, one that proved at times an important rival to the Americans. The French program put great effort into searching for uranium resources. This study explores this search, which extended in the early 1960s to several countries in South America, Brazil included. Via examination of archival sources in French nuclear program and foreign ministry archives, it argues that French geological missions there had a strong diplomatic role, complementary to the French hope of increasing its uranium supplies, and related to geophysical techniques and geological information that could be exchanged. In fact, uranium diplomacy, initiated in bilateral and multilateral frameworks, was an important element of many countries' geopolitical strategies, De Gaulle's France included.

science diplomacy, geophysics, uranium, nuclear energy, Cold War

Graft hybrids, heredity and biotechnology: the politicisation of biology and its history

Matthew Holmes, University of Leeds

Grafting – the physical joining of one plant's tissue to that of another – is an age-old technique practiced by gardeners and horticulturalists. For centuries it was believed that grafting allowed plants to exchange heritable information and bypass conventional sexual barriers. This process could potentially result in an entirely new organism: a graft hybrid. Endorsed by such luminaries as Charles Darwin, graft hybrids overturned traditional limitations on heredity as the passage of characteristics from parent to offspring. Graft hybrids promised a new means of creating novel varieties within the plant – and possibly even animal – kingdom. Yet by the mid-twentieth century, three factors had caused scientific belief in graft hybrids to enter a terminal decline. Firstly, plants once branded as graft hybrids were increasingly reclassified as chimeras: organisms comprising of distinct collections of different cells. Secondly, promising experimental results regarding graft animal hybrids were disregarded; explained away as aberrations triggered by environmental factors. Finally, the graft hybrid became tainted by association with Lysenko's biology. Yet the twenty-first century has seen the graft hybrid revived. Scientists have discovered that cellular and even nuclear fusion can occur at graft junctions. For some, these findings suggest that transgenic plants have long inhabited our gardens and orchards: a major rethink is therefore required on what we define as a genetically modified organism (GMO). For others, the graft hybrid presents an opportunity to reinvent biology and its history within a Marxist framework: casting aside Mendelian genetics and placing graft hybridisation at the centre of modern plant breeding programmes.

Genetics; grafting; Marxism; plant breeding

Anatomy's photography: Objectivity, showmanship & the reinvention of the anatomical image 1861-1950

Michael Sappol, Swedish Collegium for Advanced Study

In Paris in the spring of 1910, the polymathic surgeon-controversialist Eugène-Louis Doyen gave an anatomy lecture illustrated by lantern-slides of colored photographs of sliced mummified human bodies and body parts to the professors of the Faculty of Medicine and their students. The audience received it as a provocation; a riot broke out.

Over the past 40 years, historians have intensively studied medical photography—photographic clinics, medical portraiture, forensic medicine, photomicrography, radiography, etc. But missing from that list is the field that for centuries stood at the heart of the medical curriculum, and whose images had a privileged status in the hierarchy of medical print culture: anatomy.

Photography, with its famously powerful “reality effect,” was an emblematic technology of science and modernity. Physicians and surgeons eagerly adopted it and showed an ardent desire to photograph pathological conditions, microscopic views, laboratory experiments, surgical techniques, etc. The medical photograph had rhetorical advantages, persuaded viewers that it was a close proxy for what could be seen if the object was witnessed without any mediation.

But anatomy was slow to embrace photography. When, in the 1800s and early 1900s, Nicolaus Rüdinger, Eugène-Louis Doyen, Eliseo Cantón and other anatomists finally took to it, they took liberties. They cut, sliced, posed, and lit their cadavers and body parts in odd, idiosyncratic ways. The photographs they took were then retouched, silhouetted or colored, and outfitted with a halo of captions. The artist's pen and brush were as evident as the anatomist's saw and scalpel—and both were subject to an aesthetic impulse. The resultant photographic objects were eccentric, provocative, even shocking.

While photographic anatomy never succeeded in displacing the handworked art of medical illustration, it did have a vogue among ambitious anatomists who sought to use photography along with other approaches to modernize anatomy. Between 1861 and 1950, anatomists created and published thousands of photographs in Germany, France, the USA, Canada, Great Britain, Argentina, Ireland, Sweden and elsewhere—a truly global movement.

In this paper I will present some provocative examples of anatomical photography and consider the epistemological status, scientific claims, rhetorical power, aesthetics, and moral implications, of anatomical photography as were then debated—and as we debate them now.

Anatomy; photography; visual rhetoric; epistemology; modernity

History and Future Prospects of the Study of History of Science and Technology in Japan

Mizoguchi Hajime, Rissho University

In the present study, I investigated various activities of history of science and technology in Japan. The History of Science Society of Japan, the oldest society of history of science in Japan, was established in Tokyo on April, 1941. In the same year, the first publication of the society, entitled *The Journal of History of Science, JAPAN*, was issued. The first annual meeting of the society was held in April 1948. The History of Technology Division of the Society was established in 1951, and the *History of Technology* was issued. Also, The History of Biology Division of the Society was founded in 1954 and the *Japanese Journal of History of Biology* was issued. After World War II, many academic societies related to history of science and technology were established. For instance, The Japan Association for Philosophy of Science (1954), The History of Mathematics Society of Japan (1959), The Japanese Society for the History of Chemistry (1973), The Japan Society for the History of

Industrial Technology (1977), The Sociology of Science Society of Japan (1988), Japanese Society for Science and Technology Studies (2001), and so on.

A study of the historical study of the history of science and technology in Japan was done by the project research entitled Substantiated Research about the History and Present status of the History of Science and Technology in Japan supported by Grants-in-Aid for Scientific Research of Japan Society for the Promotion of Science from 1990 to 1992. The report, published in 1992, described a detailed chronological table of the activities of The History of Science Society of Japan from 1941 to 1991. However, there has been no research for the activities of the society after that.

Recently, themes of symposiums of the History of Science Society of Japan at annual meetings were closely related to those of other history of science and technology societies. The themes were the Fukushima nuclear disaster; ethics and social responsibility of scientists; relationship between science, technology and society, and so on. Also, other societies began to consider historical aspects of their research programs.

Therefore, chronological studies for the activities of history of science and technology in Japan for the past 25 years are needed now. The International Conference on History of Science and Technology will be a good opportunity for foreign researchers to exchange information on future prospects.

History of Science and Technology in Japan; The History of Science Society of Japan; Perspectives of History of Science and Technology

Indian Sciences and Colonial Concerns: Sir William Jones' (1746-1794) and James Forbes' (1749-1819) Impressions of Brahmanical Knowledge

Nishat Manzar, Department of History & Culture, Jamia Millia Islamia, New Delhi

William Jones (1746-1794) came to Calcutta in 1783 to join the Supreme Court. Before his arrival, he had acquired knowledge of Latin, Greek, Spanish, French, Portuguese, Arabic and Persian. He established the field of Indology and showed interest in Sanskrit language and ancient history. He realised that ancient Indian texts had much to offer in the field of science, and culture. He founded the 'Asiatic Society of Bengal' in 1784 to promote the study of Indian classics. He wrote on astronomy, philosophy and medicine and his works were published in 13 volumes. A great philologist and translator, his writings also talk about the various branches of sciences popular in India. He classified Indian flora and fauna.

James Forbes joined the English Company's services as a writer in 1765 in Bombay and retired in 1774 as a Collector in Gujarat. He was a good painter. In India he documented the life of people and political developments, prepared paintings, and journeyed extensively. His impressions are summarised in Oriental Memoirs. He was quite keen about knowing the branches of knowledge popularly understood and followed by the Indians, especially Hindus. He often criticised the sciences that evolved in the Orient, but not in a harsh tone. Forbes acknowledged that India is 'replete with novelty and entertainment: as a country, which, perhaps, precedes Egypt as a nurse of science'. About a temple of Salsette, he conceded that these structures and inscriptions had come into being when the 'nations of Europe were involved in ignorance and barbarism'. During his appointment in Dubhoy as a Collector, he observed the way Indian children, specifically Hindus, were 'instructed in astronomy, astrology and physic' and religious studies. To him, state patronage was absent to these endeavours. He was astonished to see that Brahmins of Banaras studied European works to enhance their knowledge. However, he found them far behind Europeans in imitation and improvement in the existing knowledge.

This paper tries to comprehend the perceptions of James Forbes and William Jones about the progress of sciences (and technology) on the eve of the rise of colonial power in the South Asia with a concern that Forbes, who was not highly educated, and Jones recorded their observations based on their interactions and personal readings. Both of them had their reservations about the subject. However, they had some faith in Indian medicine for its practical aspect and social significance.

Agricultural Science and Russian Avant-Garde meet at the first Post-Revolutionary Exhibition in 1923

Olga Elina, Institute for the History of Science and Technology, Russian Academy of Sciences

The paper studies the history of the All-Russian Agricultural and Handicraft Industrial Exhibition, which took place in Moscow in August 1923. The Exhibition was inspired by the idea of the Bolsheviks' leaders, V.I. Lenin in the first place, to show results of early Soviet modernization to the Russian public, especially to peasants. Simultaneously they wanted to address the global audience: more than 600 foreign companies and institutions were invited to participate as exhibitors. The high patrons of the exhibition planned to demonstrate the achievements of science in modernization of Russian agriculture. The discourses by agricultural scientists, such as S.K. Chaianov, A.V. Chaianov and N.I. Vavilov, as well as avant-garde artists, sculptors, and architects, such as A.A. Ekster, V.I. Mukhina, and K.S. Mel'nikov, in the context of the Exhibition, alluded to the ideas of Revolutionary renovation of Russia.

In particular, I will examine the role of highly esteemed rural economist Alexander Chaianov and his cousin, agronomist Socrat Chaianov in the shaping of artistic design and scientific trends of the Exhibition. Alexander Chaianov, as member of Commission for Planning, was directly involved in art discussions. He was promoting the project of the Exhibition proposed by A.V. Shchusev, an architect who rose to fame his design of Lenin's mausoleum. Young sculptor Vera Mukhina contributed with the design of pavilions; later she created the famous sculpture 'Worker and Collective Farm Girl' for World Exhibition in Paris in 1937.

Socrat Chaianov, a key figure in the Organization Committee, was responsible for the agricultural science. By that time, he had acquired a reputation as a top expert in this field. Within just 8 months Chaianov managed to submit and implement a detailed project of agricultural science exposition with leading experimental institutions as exhibitors. A number of prominent scientists, such as N.I. Vavilov, A.G. Doyarenko, N.M. Tulaikov and others, presented lectures and participated in workshops at the Exhibition.

1.5 million visitors saw the Exhibition. Public interest to the Exhibition was fueled by a combination of valuable exhibits and activities, on the one hand, and artistic design and decoration of pavilions, on the other. The Exhibition became a tool of promoting modernized techniques in agriculture, a model for the organization of future local exhibitions in the remote regions of Soviet Russia.

Agricultural Science, Russian Avant-Garde, the USSR, Alexandr Chaianov, Socrat Chaianov

Thematic cartography in the works of academician Viktor Sochava

Olga Romanova, Institute for the history of science and technology RAS

Valerian Snytko, S.I. Vavilov Institute for the history of science and technology

Olga Alexandrovskaya, S.I. Vavilov Institute for the history of science and technology

Alexey Sobisevich, S.I. Vavilov Institute for the history of science and technology

Academician Victor Sochava (1905 - 1978) made the great contribution in the fields of geography and other related subjects. He is also known as great scientist and the leader of researchers, who were involved in geobotanic mapping. Nowadays he is understood as the creator of botanic map-making as a special kind of cartography.

Victor Sochava and academician Evgenij Lavrenko were also responsible for creation «Vegetation map of European part of USSR» (1950), «Geobotanic map of USSR» (1954) and two volume edition

«Vegetation cover of URRS». The maps of vegetation of Amur basins, Baltic States, the south of Middle and Western Siberia were also created under the supervising of Victor Sochava. His activity as editor and author of numerous maps of USSR and other part of the world led the soviet geobotany school on the top of world geobotany science.

Victor Sochava understood the creation vegetation maps as very essential for understanding geographical environment. The idea of complex mapping was promoted him as great idea for international collaboration of geographers and cartographers. System approach in geography, developed by Victor Sochava, defined a new look for landscape mapping, as a kind of thematic cartography.

landscape; Victor Sochava; geobotanic

Computational techniques for exploring counterfactual histories of science

Oswaldo Pessoa Jr., Universidade de São Paulo

Causal models offer an elegant way of representing the historical development of scientific fields. They also allow the exploration of counterfactual scenarios in the history of science. In this work, two methodological strategies are used for studying possible worlds in the history of science. (I) The first strategy starts with the postulation of a counterfactual situation, for whatever reason the historian of science might have. It might involve the early death of a scientist (as in the duel in which Tycho Brahe lost his nose or when the house fell over young Fraunhofer) or the survival of a young scientist from an otherwise fatal disease (such as what took place with Thomas Melvill or Sadi Carnot). In the first case one may have the postponement of an advance, or cases in which a parallel historical path preempts the appearance of the advance. In the second case one may have the anticipation of an advance, and further analysis is required to evaluate if this would have the effect of anticipating a whole train of advances or if some conjunct (another advance which is also necessary for the progress of the field, typically a technological device) would set the pace of scientific development. The construction of a counterfactual scenario should minimize the differences with the actual world, which amounts to what may be called “the principle of the closest possible world” (PCP). (II) A second strategy evaluates the probability that a counterfactual situation may obtain, in reference to a previous branching time t_B . This evaluation is done by assuming the actual causal model of the historical episode, and applying a computer simulation that varies the time span between the advances in the causal model (according to a modified gamma distribution function), while maintaining the times of the advances that occur (in the actual world) before t_B . A guiding principle in this simulation is what is called “the principle that the actual world is the mean” (PAM). These ideas will be illustrated by several examples from the history of the physical sciences. One hopes to show that computational simulations in history of science may serve as a consistency check for the intuitions and speculations of the historian.

causal models; counterfactual history of science; computer simulations

From the astronomical instruments to the control of the captaincy: the trajectory of José Simões de Carvalho in the North region of Brazil at the end of the XVIII century

Otávio Crozoletti Costa, Universidade de São Paulo

After signature of the San Ildefonso Treaty (1777) between Portugal and Spain, it was agreed that would be necessary create commissions to demarcate the borders on the Meridional America. In the

portuguese side, some maths newly formed students by University of Coimbra were hired to make the borders demarcations and maps based on astronomical calculations. José Simões de Carvalho, doctor in astronomy, was appointed by portuguese Crown as one of the astronomers of the demarcations comissions. During the period that remained in Portuguese America produced numerous maps of the North region mainly around the rivers Negro, Amazonas, Japurá and Solimões. In an official letter dated August 8, 1801, and sent to the Secretary of State for the Navy and Overseas, Rodrigues de Sá e Melo and the Portuguese Crown, Carvalho placed himself at the disposal to be governor of the Rio Negro captaincy, a position that until then was vacant. But only in 1805 is appointed governor. The objectives of this work are 1) to identify the possible reasons why José Simões de Carvalho was interested in the position of governor, since he had been hired as an astronomer of boundary demarcations; as 2) to characterize the possible reasons by which the Portuguese Crown granted the position of governor, since there were certainly people with more experience in administrative positions (such as former governors and colonial administrators of other captaincies) and who even had closer relations with the Portuguese court. For this, the research described and analyzed the life and career trajectory of José Simões de Carvalho after his departure from the University of Coimbra, as well as contextualized the local political scenario in which he was inserted, aiming at understanding mainly the social meaning and implications of the position of governor of the Rio Negro captaincy, and also the relations between Carvalho and the political powers at their most several levels. In this way, the research was based mainly on the analysis of cartographic and textual documents, such as, requirements, letters, etc. exchanged between José Simões de Carvalho and local politicians, ministers and the Portuguese Crown. Nowadays studies aiming to investigate the relations between border-settling astronomers and political powers are very restricted, and this research provides a better understanding of the political dimension of the men of science engaged in the territorial issues of the late XVIII century.

border-settling astronomers; portuguese empire; XVIII century; political powers

Mendel's 'Hybridism': An Analysis of Two of His Theories and of Their Relationships

Pablo Lorenzano, CEFHIC-UNQ/CONICET

Mendel worked in a similar way to the school (or tradition) of “horticulturalists” (or “plant breeders”), but with the intention to answer questions raised by the school (or tradition) of “hybridists”. The main problem he faced and tried to solve was the problem of “hybridism” (“Can new species be originated by means of hybridization of preexisting species?”) and not the problem of inheritance. Based on a statistical analysis of his experiments, and seeking a “generally applicable law governing the formation and development of hybrids”, he states “the law of development/evolution found for Pisum”, which decomposes in “the law of simple combination of characters” and in “the law of combination of different characters”. But neither of them is identical to the laws usually attributed to Mendel. He states them in terms of characters, and not in terms of “factors” or “genes”. When Mendel tries to provide the foundation and explanation of the law of formation and development of hybrids, he does it in terms of the production and behavior of egg cells and pollen cells, and, ultimately, in terms of the nature and behavior of elements or cell elements. But the concept of element is different from the Classical Genetics’ concept of factor or gen. Besides, Mendel recognizes the existence not just of variable hybrids that behave like those of Pisum, but also of constant ones that “remain perfectly like the hybrid and continue constant in their offspring” and “acquire the status of new species”. Thus, Mendel supports “hybridism (in the narrow sense)”, i.e. hybridism conceived as establishing a mechanism of speciation, that is, of evolution. And the law that would govern the behavior of constant hybrids would also find its foundation and explanation in terms of the nature and behavior of elements. For all these reasons, it can hardly be said that Mendel had been a proponent of Classical Genetics. In fact, it might be said that he was an excellent “hybridist”, who proposes two theories: a first theory that moves on a more “empirical” level, which

can be called “Mendel’s theory of the development/evolution of hybrids”, and a second theory that moves on a more “theoretical” level, which can be called “Mendel’s theory on the cellular foundation of the development/evolution of hybrids”.

The aim of this communication is to present a conceptual analysis of these two theories and of their relationships.

Mendel; Hybridism; Theories; Relationships

Metric Decimal System - Provincial efforts for its implementation in the Amazon, Brazil

Patricia de Campos Correa, UFPA

The industrial growth in Brazil allowed a new relationship between consumer and merchant with the adoption of the modern system of measure in accordance with the scientism that emerged at the time. In this sense in 1862, D. Pedro II influenced by people who were consistent with the thought of scientific rationality, promulgated the imperial law number 1,157 which established the Metric Decimal System which was created in France during the Revolution, and established a period of ten years for the definitive abandonment of other units of measures and distribution throughout the kingdom, also made it compulsory to teach it in schools. In this sense, this research intends to show how the Metric decimal system was introduced in the Amazon, north of Brazil. For this, we intend to analyze the discourses and the conditions that made possible the implantation of the new system. Identify the efforts to enable the introduction of the metric decimal system. In addition to show how the context in which this occurs. Especially the cities of Belém and Manaus that underwent modifications to the molds of European cities like Paris. Thus, the streets will be illuminated, drained, sanitized, with sewer networks, paved, neat to become beautiful. The cities received standardizations for the construction and beautification of houses, squares, and the normalization of the behaviors of the population that should completely abandon their bad habits of hygiene, noise, among others in order to become people more consistent with the modern times financed by the growing rubber economy. After the ten years stipulated by the imperial law, the Legislative Assembly of Pará Province regulated by decree Law 809, the collection taxes based on the new system in all the markets, however, the circulating discourses of the government itself did not completely dissociate of the units of measurement used previously. Although government efforts at teacher competitions to teach such a system in public schools the acquisition and distribution of measurement equipment by various North cities carried by the vapors, mainly linear measurements were still rooted in the previous format. The ways of measuring coexisted in the discourses of the time, evidencing a period of transition of appropriation of a new knowledge.

Decimal Metric System, Province of Gran Pará, History of Science

La cartographie suisse des expéditions coloniales / Cartography of the Colonial Expeditions in Switzerland

Patrick Paul Minder, CERF University of Fribourg

Contrairement à une opinion reçue, la Suisse est très active au moment des expéditions coloniales. A Genève, la revue L’Afrique explorée et civilisée (1879-1894) fondée par Gustave Moynier, co-fondateur de la Croix-Rouge internationale et consul de l’Etat indépendant du Congo en Suisse, publie les récits des explorateurs accompagnés de nombreuses cartes. Les employés suisses des Etats

coloniaux font de même en établissant des relevés censés aider les administrations coloniales dans leurs tâches de domination et d'expansion.

Par la suite, des expéditions scientifiques suisses, notamment à deux reprises en Angola (1928-1929; 1932-1933), sont organisées de même que des exploits sportifs comme la première traversée du continent africain en hydravion réalisée par des Suisses du Cap au Caire (le Raid Aérien Suisse Transfricain par Walter Mittelholzer en 1926, cofondateur de la compagnie Swissair).

Des cartes accompagnent les récits qui sont publiés non seulement dans les revues populaires et les quotidiens, mais aussi dans des revues scientifiques de référence comme, par exemple, le Bulletin de la Société neuchâteloise de géographie.

Notre propos sera de montrer comment l'espace exploré durant ces expéditions est cartographié de façon particulière et comment les Suisses se positionnent activement par rapport aux autres puissances coloniales. On proposera des extraits de cartes et des analyses comparatives tirées de nombreuses sources et des archives suisses, mises en perspective avec des caricatures et des prises de position critiques.

expéditions scientifiques suisses; cartographie coloniale suisse

Impacts of France's scientific cooperation (France-AmSud) on the regional integration of South American scientists

Paulo Henrique Ribeiro Neto, PROLAM - USP

This study aims to evaluate the possible impacts that the french delegation "France-AmSud" has had in the production and cooperation among South American scientists who were funded by one of their initiatives for researchers in the region (Math-AmSud or STIC-AmSud) between the years of 2012 and 2015. Since 1990, France maintains a diplomatic corps in South America with the objective of promoting and enhancing collaborations of french actors and agencies with local institutions in various fields. Furthermore, specifically through its academic branch of activities, it is also a goal of the delegation to ensure that networks of investigation between european and south american scientists are created and strengthened. Through the lens of many post-colonial authors, this initiative could be seen with distrust: the interference of one of Latin America's former colonizers in our scientific research could be a way to recolonize the continent (in a process of "recolonization of thought"), preventing the local academic communities to collaborate with one another and possibly avoiding the creation of an autonomous regional science. However, is that the case here? Are both of these french initiatives bringing south american researches closer and promoting cooperation between them? Or are the former participants of the programs now further from the regional scientific production and cooperating more frequently with european institutions? These are some of the questions this research aims to adress. From the 39 projects supported and concluded by Math-AmSud and STIC-AmSud between 2012 and 2015, three case studies were selected. All south american coordinators of these projects, members of institutions and universities of five countries of the region (Argentina, Brazil, Chile, Paraguay and Uruguay), were interviewed for this study and their recent production, as well as the documents and reports produced during the projects, are being gathered and analyzed. As this is an ongoing investigation, the final conclusions will be made public only in February 2018, when the master dissertation will be presented at the University of São Paulo (USP). Nonetheless, some early results might be presented and discussed during the 25th ICHST. This study is funded by the Coordination for the Improvement of Higher Education Personnel (CAPES).

France-AmSud; Scientific cooperation; South American integration; International Relations;

Revisiting Brazilian Mathematics History between the end of the XVIII and start of the XIX Century

Paulo Henrique Trentin, Centro Universitário da Fei/Universidade de São Paulo

This presentation is part of the researcher's post-doctoral studies at the University of São Paulo (USP). The data focuses on aspects of Manoel Ferreira de Araújo Guimarães' life from 1777 to 1838. Firstly, considerations are raised his education in Portugal. The bases for such considerations are documents and specialized publications on Brazilian Education and on the History of Brazilian Mathematics which support the researcher's claim about the need for a Historical Review of Brazilian Mathematics. Such a claim is supported by analyses of texts that mention identities, achievements and roles that marked the life of Araújo Guimarães. The researcher concludes by pointing out aspects to be developed in further studies, in which he will identify the web of social and political relations that involved Araújo Guimarães by reviewing and re-signifying the Brazilian period between 1777 and 1838, in which he lived and constituted various identities as a teacher, translator, chief-editor and politician.

History of Science - History of Mathematics Education - History of Brazilian Mathematics - Manoel Ferreira de Araújo Guimarães-Paulo Henrique Trentin

Did Soviet Union be intended to provide backward technology? A study on the China Choice process of nuclear reprocessing technology in 1960s

Pei Liu, University of Science and Technology of China

Zhihui Zhang, University of Science and Technology of China

Nuclear reprocessing technology was developed to chemically separate and recover fissionable plutonium from spent nuclear fuel. Originally, reprocessing was used solely to extract plutonium for producing nuclear weapons. With the commercialization of nuclear power, the reprocessed plutonium was recycled back into reactors. Nowadays, only a few countries grasp this cutting-edge technology for high radiotoxicity, huge recovery of plutonium (>99.5%) and critical safety. In 1956, as soon as it launched its nuclear weapon program, China began exploring possibilities for military reprocessing with the Soviet aid. The reprocessing technology provided by Soviet was based on precipitation of slightly soluble sodium uranyl acetate, $\text{NaUO}_2(\text{CH}_3\text{COO})_3$ from nitric acid solutions containing dissolved uranium fuel. The 10th Research Division of Atomic Energy Institute (AEI) was set up as a special research organization to master precipitation method. After the Soviet stopped its aid in 1960, China began to study and reevaluate the precipitation method. The Second ministry of Machine Building Industry made alternate plans in Liu Yunbin's proposal, the director of 10th Research Division of AEI. Plan A was to continue the verification of precipitation method in 10th Research Division of AEI and Plan B was to make an exploration and research on the advanced Purex method developed in the United States by Tsinghua University. After repeated demonstrations and arguments, China finally abandoned the precipitation method and switched to Purex at the end of 1964. The results of hot test performed parallelly by AEI and Tsinghua University showed that the Purex method was feasible. The technology and its application in nuclear fuel reprocessing plants made China one of the leading countries in this field throughout the world. Some experts have blamed the Soviet provided backward technology that made China take a detour in early stage. This view is echoed by famous Chinese historian Shen Zhihua, because it seems reasonable to consider that the Soviet Union has some reservations from a logical deduction. In this paper, it demonstrates that the Soviet Union did not be intended to provide backward technology.

Nuclear fuel reprocessing; Soviet's aid; precipitation method; Purex method

An Ethnography Of The Ova Flows: Exploring Political Economy And Material Agency Behind The Transnational Ova Exchange

Polina Vlasenko, Indiana University

This paper explores how the emergent ova donation market in Ukraine oriented specifically toward (West) European purchasers is assembled in the context of the structural inequalities of global political economy and shaped by the material agency of the exchanged donor eggs. While the for-profit reproductive medical industry transforms the main object of transnational ova exchange into the neutral commodity freely circulating across national borders, the egg itself necessarily entails an intimate bodily connection between its Ukrainian donors and international recipients and embodies their differential positions within hierarchical structures of the global political economy. I rely on the concept of material agency of the egg as a theoretical tool that allows to explore these intimate connections between the actors involved in its exchange and reveal the particular formations of the global political economy and stratified reproduction concealed behind its universal objectification and neutralization by technology. This paper investigates how the nature of the human biologicals and the material conditions required for their production, exchange and use, structures the experiences of egg donors as precarious laborers on the ova donation market and shapes the life trajectories of all other involved actors in Ukraine and across its borders. It is based on the results of the interviews with Ukrainian egg donors, medical professionals and international coordinators, as well as participant observation in one of the private fertility clinics in Ukraine, that constitutes a large hub for the recruitment of Ukrainian egg donors for international couples and transportation of gametes and embryos between Ukraine and Europe. By accounting for the agency of the non-human, I hope to shed some light on those material conditions that structure the practices and relations of human actors and examine what is the share of human responsibility in the constellation of power within global ova donation assemblage.

Transnational reproduction, ova donation, Ukraine, political economy, material agency

Chunilal Bose (1861-1930) and his contributions to chemistry in Colonial Bengal

Professor Chittabrata Palit, Institute Of Historical Studies, Kolkata

During the colonial period many Bengali scientists had contributed to the efflorescence of science and technology in Bengal, the notables among them being Jagadish Chandra Bose, Acharya Prafulla Chandra Ray, Dr Mahendralal Sarkar, Chunilal Bose and others. Although Chunilal Bose's contribution to the cause of promoting national science is not clearly known, however he raised his voice against an important social malady that is food adulteration. This apart he was a brilliant chemist. He also devoted his life for inculcating awareness amongst the Indians regarding health and sanitation. Chunilal wrote several articles on diseases such as small pox and diabetes. He sought to create a public opinion in favour of a pollution free environment. He showed deep concern for the health and sanitation for the villages in colonial Bengal. To him education could be the key to any kind of reform. He also sought to incorporate indigenous science and medicine with the Western line of treatment. He was known as Rasayanacharya for his immense contributions in the field of chemistry. Chunilal Bose was the pioneer in the field of nutrition and diatetics in Bengal, and his contributions served to pave the way for posterity to achieve the promotion of science and technology of this province. Patriotism writ large Chunilal was actively associated with the nationalistic fervour being actively associated with nationalist bodies such as IACS, BCPW, Indian Chemical Society. Chunilal attempted to popularize science and sanitation by writing in vernacular.

Scholarly achievements apart, he wrote the biography of Sir Gurudas Banerjee and few Bengali literary pieces. He gave a clarion call to the Bengalis for self enrichment and as an outcome of his staunch protest, the British Government had to pass an act to prohibit free sale of poisons in Bengal. Apart from his contributions in the field of chemistry, Chunilal Bose's achievements as a doctor are noteworthy as well.

health, nutrition, chemistry, nationalist, sanitation

Measuring the Heaven and Earth: European Jesuits and Their Scientific Activity in China

Qi Han, Institute for the History of Natural Sciences, Chinese Academy of Sciences

In the past two decades, scholars paid great attention to scientific activities at the imperial court of the Kangxi emperor (1654-1722). In introducing European science into China, the Jesuits played a crucial role. In this paper, I would like to discuss why European Jesuits made astronomical observations in China from an institutional point of view. In addition I will analyse why the map-surveying was launched in early-eighteenth century China in its social context.

Jesuits, China, astronomy, cartography, France

Minds and Machines: Intelligence at Midcentury

Rebecah Pulsifer, University of Illinois at Urbana-Champaign

This presentation traces conceptual connections between research on intelligence by educational psychologist Cyril Burt and polymath Alan Turing. While Burt sought to stabilize the concept of human intelligence by arguing it was innate, hereditary, and measurable, Turing attempted to demystify machine intelligence by claiming that its roots lie in processes of imitation. Especially influential in their respective domains c. 1940 – 1950, Burt and Turing each approached intelligence as a British national resource in need of enhancement for the betterment of the population and for scientific advancement.

I argue that Burt and Turing participated in a multidisciplinary cultural reframing of intelligence, in which intelligence began to be understood as tangible and manipulable. No longer primarily associated with private, individual contemplation, in other words, intelligence was increasingly understood as a quality of public importance, enabling the practices of empirical science to understand and improve it. This reframing had both local and global effects, as the immediate applications of Burt's and Turing's research demonstrate; the U.K.'s 1944 Education Act, which established the Tripartite System, was premised on Burt's claim about the heritability of intelligence, while Turing's approach to machine learning informed military research on artificial intelligence. Drawing on recent critical work by Ronald Kline, Ruzena Bajcsy, and Joris Mercelis, I claim that the social and conceptual links between Burt's and Turing's research are indicative of a broader cultural fascination with the biopolitical stakes of intelligence in the mid-twentieth century.

psychology; education; artificial intelligence

The Eclipse of 1919 and the Diffusion of Science through Museu of the Eclipse

Regina Celi Fonseca Raick, Universidade Estadual Vale do Acaraú/ECOA
Emerson Almeida, Universidade Estadual Vale do Acaraú/ Museu do Eclipse

1919 one of the most unsuspected dates in the history of science has many consequences for the very understanding of the world and how politics and ideology may come together to create a misleading history. Einstein's theory of relativity through the on coming years from its first publication, 1905, had an impact on the international astronomical committees that resulted in the commissioning of national scientific observers to verify the experimental possibility of the theory through the observation of a total eclipse of the sun.

Two places in the world were designated as the most promising sights of the phenomenon the island of Cabo Verde and Sobral, Ceará, Brazil. The unquestionable results were those of Sobral, even if the recent popular science literature appoint the results as those of the English Committee taken in Cabo Verde. The photographs and the calculus that they offered were instantly published in international newspapers and the subject of debate in the various scientific communities.

1999, Sobral, the city, was recognized as a National Monument, because of its important register of colonization and occupation of one of the most difficult climate and strategic geographical confluences of the interior of the country. In this same year, in a very able move, the Museum of the Eclipse was created and open to the public. As a symbol of identity, the museum recovered the popular understanding of the importance of the presence of the scientists that stationed in Sobral from the end of 1918 to the Eclipse, 29th of May of 1919. Absorbing the already existing monuments, the creation of the building that houses the collection of historical documents and a potent telescope this small science centre has as mission disclosure and instruct not only students of Physics but young astronomers to the very history of the Theory of Relativity but to the other aspects and repercussions of the study. Today the Museum is not only an important equipment for the educational program in the city, that plays a role model in public education, but an important observatory of the sky once the climate and geographical attributes are ideal: clean skies. The Museum complex is located in the area chosen by the various committees and now has not only the museum but a planetary open to the public with a diverse program.

Eclipse of 1919; Sobral; Museum; Relativity Theory

Historical collection of Vital Brazil of the Natural History Museum

Rejâne M. Lira da Silva, Universidade Federal da Bahia
Milena Soeiro, Universidade Federal da Bahia
Tania K. Brazil, Universidade Federal da Bahia
Érico Vital Brazil, Casa de Vital Brazil
Marta Lourenço, Universidade de Lisboa

The Natural History Museum (1881) has a collection of about 70 million species. The Natural History Museum (NHM) has always been a reference in the memory of the world's fauna, in a time where experienced professionals were lacking and it was possible to send specimens of the Brazilian fauna to specialists to help identify species. We aim to present the historical collection of serpents and letters of Vital Brazil, sent to George Albert Boulanger (1958-1937), to the Natural History Museum, one of the only museums that holds this collection. Vital Brazil who prospected the largest collection of neotropical snakes in the world at the Butantan Institute, destroyed by a tragic fire on May 15, 2010. The historical collection of Vital Brazil has 16 species: *boa constrictor* LINNAEUS 1758; *Epicrates cenchria* LINNAEUS 1758; *Echinanthera undulata* WIED 1824; *Erythrolamprus miliaris* (LINNAEUS 1758); *Tropidodryas striaticeps* COPE 1870; *Rhachidelus brazili* BOULENGER, 1908; *Xenodon neuwiedii* GÜNTHER 1863; *Micrurus corallinus* (MERREM, 1820); *Micrurus altirostris* (COPE,

ICHST
2017

1860); *Bothrops alternatus* (DUMÉRIL, BIBRON & DUMÉRIL, 1854); *Bothrops itapetiningae* BOULANGER, 1907; *Bothrops jararaca* (WIED, 1824); *Bothrops jararacussu* (BOULENGER, 1907); *Bothrops moojeni* HOGE, 1966; *Bothrops neuwiedi* (WAGLER, 1824) and *Crotalus durissus* LINNAEUS, 1758, all collected in the state of São Paulo (Brazil) and belonged to the breeding facility of the Instituto Serumtherapico do Estado de São Paulo (Instituto Butantan). Of these, two new species were described by Boulenger, *Bothrops itapetiningae* (1907) and *Rhachidelus brazili* (1908). The specific epithet for *B. itapetiningae* was a request from Vital Brazil to Boulenger, as a tribute to the city of Itapetininga in São Paulo, where the animals were collected. The specific epithet of *R. brazili* was a tribute from the curator to the scientist, who sent him the copy that gave rise to the description of this new species. The record of this collection is documented in eight letters sent by Vital Brazil from 1906 to 1908. Analyzing this historical collection, plus the letters, we can conclude that Vital Brazil had the interest in solving doubts related to the taxonomy of Brazilian snakes, which resulted in the description of new species, especially venomous snakes, linking biology to clinical practice in favor of better care of the injured.

History of sciences, collections, snakes

Medical thought in Portugal and the trajectory of Francisco de Mello Franco 1790-1821

Ricardo Cabral de Freitas, Fiocruz

The communication intends to show some of the transformations in the conceptions about body and disease articulated by the medical elite in Portugal after the reform of medical studies at the University of Coimbra in 1772. For that, I will take as reference the trajectory of the Brazilian physician Francisco de Mello Franco in the court of Lisbon. A graduate student at the University of Coimbra, Mello Franco moved to the capital in the late 1780s, where he quickly joined the groups of the Portuguese medical elite. His personal connections and his talents as a practitioner of medicine enabled him to participate in some of the most important spaces of Portuguese intellectuality, where proposals of social and hygienic reform of the country were debated. As a member of the Lisbon Academy of Sciences, he published the *Tratado da educação física dos meninos* (1790), *Elementos de higiene* (1814) and *Tratado sobre as febres do Rio de Janeiro* (1821), all works committed to promoting hygiene and Preventive medicine in the Luso-Brazilian Empire.

The medical references mobilized by Mello Franco in his works indicate the appropriation, in the Portuguese context, of renewed conceptions about the relations between the physical and moral, also shared by other intellectuals of the same period. The communication intends to show that this appropriation was conditioned to the possibilities offered by the political scene in the kingdom, which gave particular characteristics to the process if compared to other European contexts.

History of medicine; Enlightenment; Coimbra University; Portugal

Original uses of complex numbers in XIX century optics: Contributions of Fresnel and Cauchy

Ricardo Karam, University of Copenhagen

Complex numbers were primarily conceived in the sixteenth century as a tool to solve cubic equations. At a first glance, it seems unlikely that complex numbers could be useful for understanding the physical world. However, more than two centuries after their invention, physicists gradually began to utilize

complex numbers to model different kinds of physical phenomena, a process that has been called "complexification of physics" by Salomon Bochner. In this work, two case studies that illustrate innovative uses of complex numbers in the nineteenth century optics are presented.

The first is the original derivation of Fresnel's equations (1823), which relate the amplitudes of the reflected and incident waves when plane-polarized light is reflected. When Fresnel encountered a situation where the square root of a negative number appeared he evoked a general law of continuity (*loi générale de continuité*) and demanded some physical interpretation to the complex expression, which eventually led him to predict a phase shift due to reflection. Although phase shift associated with reflection was a known phenomenon at the time, his calculations with complex numbers provided an accurate numerical description that enabled Fresnel to design precise optical instruments (Fresnel Rhomb) to produce circularly polarized light.

The second case concerns a posterior use of Fresnel's theory to investigate metallic reflection. The phenomenological observation that under certain circumstances plane-polarized light was elliptically polarized after being reflected by metallic surfaces demanded a theoretical explanation. Among the attempts to provide such explanation, Cauchy (1839) proposed to introduce into Fresnel's formulas a refractive index that is a general complex number, where the real part is the "real" refractive index and imaginary part is an index of absorption.

Fresnel's case is not only interesting because it illustrates how abstract mathematical reasoning can reveal a hidden physical reality, but also because this particular geometric interpretation of complex numbers was not widely known at the time, so that one can also possibly say that Fresnel made an original independent interpretation of complex numbers himself. Cauchy's case exemplifies the flexibility of mathematics to describe physical phenomena and motivates the question of how physical problems were sources of inspiration for Cauchy's development of complex analysis.

Complex numbers; XIX century optics; Fresnel; Cauchy

Reassessing Franciscan Amazonian Science in the Age of the Enlightenment

Roberto Chauca, University of Florida

Unlike the misconceptions and anachronisms that plagued most of the historiography of colonial science in Latin America, labeled as either "backward" or "derivative", missionary science has been long considered a site of excellence, though basically within the realm of the historiography produced by friars themselves. This is the case of the cartographic and geographic Amazonian knowledge that Franciscan friars from the Province of Peru garnered, systematized, and circulated between the seventeenth and eighteenth centuries. The historiography of Franciscan Amazonian science, however, still experiences two issues, both of them related to its status during the so-called Enlightenment. On the one hand, "civilian" scholarship either neglects it or treats it as less valuable than other scientific enterprises of the second half of the eighteenth century. On the other, Franciscan scholars tend to assign a label of "excellence" to their fellows' Amazonian knowledge due to the fact that most of their cartographic and geographic works started to appear in printed form at the end of that century. The "civilian" approach is problematic because it does not situate missionary science in its right place, that is, as the provider of the knowledge that colonial bureaucrats and officials would produce about Western Amazonia. Meanwhile, the "missionary" viewpoint is equally lacking because the focus on its supposedly late-eighteenth-century grandeur makes them neglect the long and rich tradition of mapping Amazonia that their fellow Franciscans had initiated at least since the middle of the seventeenth century. This presentation, then, has two objectives: to rearticulate the relationship between missionary and civilian science in the Viceroyalty of Peru and to reassess the importance of the pre-Enlightenment Franciscan knowledge production of Western Amazonia.

Franciscans, Amazonia, cartography, geography

Political Technologies. Reinforced concrete and modernization of the territory in Chile (1906-1925)

Rodrigo Booth, University of Chile

This paper aims to study the political trajectory of reinforced concrete as a construction system used by the Chilean State to expose its modernizing capacity in the first quarter of the 20th century. The work will study the place of reinforced concrete in political discussions after the earthquake of 1906, when it was considered as the main technological innovation in the field of construction engineering at the turn of the century. Reinforced concrete would serve to face socio-natural disasters that had marked the history of the country in the previous centuries. The state and public debate will be attended, both in light of the opinions emanating from the Ministry of Industry and Public Works, as well as from the parliament and the non-specialized press that conformed the Chilean public opinion. It is proposed that from the earthquake of 1906 and due to the seismic frequency that Chile faced, this country was inserted within a global system of technology transfer associated with innovation in the field of construction. The process of incorporation of reinforced concrete carried out by the State will be studied until 1925, when the "bridge law" was approved, a project that accelerated the replacement of the old wooden bridges by modern bridges of reinforced concrete. This moment coincided with the collapse of the building of the Caja de Crédito Popular in Santiago, an accident that cast doubt on the condition of stability, indestructibility and a-historicity with which the use of reinforced concrete had been promoted since the great earthquake of 1906. From the analysis of the opinion that the political and technical authorities of the state had on reinforced concrete and the public debate that generated both their protective action and the risks associated with construction, it is possible to consider that the irruption of this system generates a series of controversies that also took place in the political debate.

To conclude, this work will report on the action taken by the State over the national territory to address the transformation of infrastructures from the use of large-scale reinforced concrete during this period. Among other works road construction, railway bridges, public buildings, hangars, airports, ports will be addressed. All these works of territorial transformation placed the reinforced concrete as a symbol of the process of modernization carried out by the Chilean State in the first decades of the twentieth century.

Reinforced concrete, Politics, Technology, Chile, Earthquakes

Description of a built space through technique: A study about the former residence of Intendente Antônio José de Lemos in the city of Belém in Pará State

Rony Helder Nogueira Cordeiro, IBGE, Brazil

Cybelle Salvador Miranda, UFPA, Brazil

Maria Paula Diogo, FCT/UNL, Portugal

This paper presents an analyse about generation, import and adoption of technologies in Brazil during the end of 19th and beginning of 20th Centuries, with highlight on the technical iron cycle and its employment in Belém of Pará architecture. The early 20th century building located on Batista Campos neighborhood, wich is surrounded by Belém's historical center, was adopted as case of study. It served as residence of Antonio José Lemos (1843-1913) – a remarkable character, icon of city history, who was Intendant of Belém between 1897 and 1912 – and his family during the period 1906-1912. The built space represents one of the political landmarks historical divisors and for so is declared as heritage by municipaly and state administration. In order to contextualize the place

where technology is taken, its relationship and its historical context, a systematic effort to identify and read historical documents in different kinds will be made: dealing with cultural, political, economic and social aspects of its epoch in a regionalized point of view, without losing the focus on national and world events however. Simultaneously, the remaining tectonic signs of the building based on traces in the soil and contemporary buildings will be studied based on traces in the soil and contemporary buildings to the object of study, which remains on the site and allows to reconstruct the original building, a symbol of history material of the city culture destroyed by arson in 1912. The goal is to gather the required information for the analysis of built artifact, its construction system, production conditions and epistemology of the object as architectural and technical engineering, available and necessary for its construction at the time.

iron architecture; technology transference; technique history; Belém-Pará

Between Christian and Science: Western Knowledge in the Journal Progress in Early Twentieth-century China

Ruhong Wu, Department of History of Science, University of Science and Technology of China

The Journal Progress (Jinbu) was firstly published in 1911 by Shanghai YMCA (Young Men's Christian Association) which was founded for the promotion of American Foreign Missions Movement and the requests of missionaries in China during that period. As a part of intellectual programs of Shanghai YMCA, this journal took little account of evangelism, otherwise than the first journal named China's Young Men: Chinese Edition, it aimed to enlighten young people through progressive thoughts and advanced knowledge. In addition to the introductions of western countries' situation, a special column in the journal was established for introducing basic scientific knowledge and the applications of new technology. Most of this kind of knowledge was translated from foreign newspapers and journals which was expressed understandably in very brief. This paper will discuss why these Chinese Christian intellectuals selected this kind of knowledge, which not only can reflect Christian intellectuals' knowledge structure at that time, but also express their understandings and attitudes to western scientific knowledge.

Progress; Shanghai YMCA; scientific knowledge; Christian

The transformations of military technology in the United States and the Videogame War: the Powell Doctrine and the Gulf War (1991)

Sandro Heleno Moraes Zarpelão, Federal Inst. of Education, Science and Technology of São Paulo

On January 17, 1991, the skies of Baghdad in Iraq saw the first coalition missiles of 34 countries, led by the United States, to fall on the city. Iraqi anti-aircraft batteries have begun to reject the American attack whose images were captured over the subsequent days by the CNN television lenses as if it were a Video Game War. The euphoria of the market economy, neoliberalism, and representative democracy marked the international relations of the 1990s. Newspapers from the United States, Western Europe, and Latin America boasted the imminent end of the Cold War and the "end of history," Defended by Fukuyama. The attack on Baghdad marked the beginning of the Gulf War, when the United States set its military machine in motion through Operation Desert Storm against Iraq. It was the Powell Doctrine being applied in the military and strategic field. To this end, the United States government has undertaken a large alliance of countries and has put into practice a new doctrine of military, diplomatic and international relations known as the Powell Doctrine at a time of great

transformation in the international geopolitical scenario with the end of the Cold War. From the disastrous experiences faced by the great powers in wars, in the case of France, the Algerian War (1954-1962), the United States, the Vietnam War (1965-1975) and the Soviet Union, the 1979- 1989) a series of military transformations were being engendered, mainly in the field of military technology. In this way, the objective is to analyze, in general terms, how the process of military transformation and development of new military technologies occurred and how this became the great bet of the United States. In order to do so, we will study the military transformations, with emphasis on military technology, the impact of Vietnam in this process with changes in the bureaucratic structure of Defense, such as the creation of TRADOC, strengthening of DARPA, change in Force Profile, Carter, creation of the SDI, elaboration of the Weinberger doctrine, Goldwater-Nichols Law and the creation of the Delta Force. These transformations led to the need for a new military doctrine and international relations, in this case the Powell Doctrine, which was applied in the Gulf War through the US-Iraq Desert and Desert Storm Operations, Invasion of Kuwait on 2 August 1990.

Gulf War, Doctrine Powell, Military Technology, Transformations, Desert Storm

“Ruined River” and Dutch Engineers: the Pros and Cons of Dutch River Improvement Techniques in Modernizing Japan

Satoshi Nakazawa, Toho University

After the Meiji Restoration (1867), the Japanese government invited a great number of civil engineers from the Western countries in order to improve infrastructure required for the modernization of the country. Most of them were the British, while a relatively small group of Dutch engineers were engaged in the field of water management. They made improvement plans for several important rivers and harbours through the country. Their activities have left a remarkable trace in the history of land development in Japan.

In the historiography of Japanese water management, the river management technology that the Dutch engineers have transferred to Japan was often called the ‘Dutch techniques’, with the special implication that it possessed some features of Dutch origin. Moreover, there have been some negative opinions that the activities of the Dutch engineers, based on the techniques developed under very different physical conditions, were doomed to be unsuccessful. In other words, the Dutch river management technology, being extraneous in origin, should have failed to adapt the Japanese local environment.

After the World War II, however, some authors began to call such opinions into question. Kurihara Toyo initiated researches to reevaluate the activities of the Dutch engineers. He pointed out the facts that Dutch hydraulic engineers were working all over Europe, e.g. for the improvement of the Oder in Prusia. In addition, the Dutch had successfully developed water works in Indonesia ‘whose cultural as well as geographical situations were rather similar to Japan’.

In fact, the contradicting evaluations of the ‘Dutch techniques’ have originated in the Meiji period. There were a number of actors who had participated in the discussion about river management with their particular purposes. It was a struggle over the technological orthodoxy in the Post-Restoration Japan. In this presentation, I try to analyze the discourses about the ‘Dutch techniques’ of the time and suggest an explanation about how the stereotype image of the ‘Dutch techniques’ was constructed in the struggle.

Water Management, River Engineering, Japan, The Netherlands

China Brazil Earth Resources Satellite Program-An Excellent Example of South-South Cooperation in High-tech Areas

Shi Haiming, School of Humanities and Social Sciences, National University of Defense Technology, Changsha
Huang Jia, National University of Defense Technology

In the 1980s', developed countries monopolized the earth remote sensing market, thus the remote sensing products were expensive and the continuity of service could not be ensured. Against this background, the Chinese and Brazilian governments decided to jointly research and develop the China Brazil earth resources satellite (CBERS) after friendly negotiations. It takes more than 10 years from the establishment of this program to the launch of CBERS-01. During that period, China and Brazil coordinated and cooperated with each other so as to overcome difficulties and this led to the success of this program. Since their practical use, the CBERS satellites have made important contributions to the economical and social development of both countries and exerted significant influences upon other countries and areas within the world. The success of CBERS projects breaks developed countries' technological monopoly and sets up excellent examples for the cooperation in the peaceful use of outer space and for the south-south cooperation in high-tech areas within the globe. The successful experiences of the CBERS program indicate that international cooperation is an effective means of the R&D and application of space programs; mutual trust and mutual benefits are the prerequisites for the international cooperation in space programs; rules and regulations are the foundations for the success of international cooperation in space programs; organization and management are the key to the success of international space programs.

China Brazil earth resources satellite (CBERS); south-south cooperation; high-tech

Between Ancient and Modern Map: A Study of the Japanese-made Seoul City Map, 'Chosen-Keijo-Zu'

Shizuaki Shibuya, Chubu University

The aim of this paper is to discuss how a Japanese cartographer made a Korean city map without using survey maps by examining 'Chosen- Keijo- Zu' (map of Seoul, 1882).

Before the World War II, many of the maps of Korea and its cities were made by Japanese cartographers. Many private maps started being made, especially at around the time of the First Sino-Japanese War (1894), owing to Japan's increased interest in the Korean Peninsula. However, scarcely any modern surveys were conducted in the Korean Peninsula before 1910, and owing to insufficient information, there were cases in which old maps of Korea from the Joseon period were used as a second-best policy. High-quality old maps were produced in the Korean Peninsula from the eighteenth century onward.

It is believed that the cartographers made 'Chosen- Keijo- Zu' without relying on old Korean maps. This map is one of the oldest Japanese-made Seoul city maps. The cartographers were three military attachés from the Japanese legation, including army infantry captain Katsuki Mizuno. At the time of the map's making, there was a struggle for power between the Qing Dynasty and Japan. This was just after the Imo Incident (1882), when the Japanese legation was attacked. The incident underscored the Japanese need for a detailed (large scale) map of Seoul.

The 'Chosen- Keijo- Zu' map is at the scale of 1:40,000, and the map shows developed areas as well as surrounding landforms such as mountains and rivers. It is recorded in a note on the map that 'we walked around surrounding mountains of Seoul city and drew the map by measurement with the eye and imagination. We have to note that this map is not perfect.' One can see that a mountain ridge line is drawn in detail, but a built-up area is drawn simply with little information provided. Also, the

relative positions of places on the map is not quite exact. However, the cartographers found that the Seoul City Wall is not round but an undetermined form, although many old maps of Seoul show the City Wall as round. This map, therefore, may be viewed as a gateway to the modern city maps.

Korea; Seoul; Modern City Map; Japanese; Old Maps

The Introduction of American-originated Crops and the Long-term Social and Economic Development in China

Siming Wang, Nanjing Agricultural University

From the 16th to the 19th century, over 30 species of American-originated crops were introduced into China. Different from the cases during the Han and Tang dynasties, there were not only fruits and vegetables, but also quite a few important main food crops such as maize, potato, and sweet potatoes. Because of their characteristics of high yielding, drought and cold resistance, these crops were fast spread throughout China, especially in the mountainous and barren areas.

The extension of American-originated crops have left long-term impacts upon the social and economic developments in China, e.g. the dramatic increase of population, more benefit for the farmer, enriching the diets of ordinary people, more fodder crops for the development of husbandry, and more efficient ways of land utilization. From 1600 to 1880, Chinese population increased six times, no doubt, the extension of American-originated crops made an important contribution in this process.

American-originated crops; introduction; extension; Chinese agricultural history

Transatlantic Science Diplomacy: NATO and the promotion of scientific collaboration during the Cold War

Simone Turchetti, University of Manchester

The last century has seen an unprecedented growth of international collaborative enterprises in science and technology across the world in the form of coordinated fieldwork; the setting up of joint laboratories for experimental studies; and synergies between national groups interested in exchanging knowledge in specific fields. Scholars who have looked at these historical developments have emphasized their added value in terms of both connecting local centres of knowledge production and improving international relations. The notion of 'science diplomacy' has recently encapsulated these merits and, at the same time, characterized how the circulation of new knowledge circulation has gained currency, globally, during the 20th century and beyond.

The North-Atlantic Treaty Organization (NATO) was amongst the multilateral organization to appreciate the benefits to be derived from promoting collaboration in science and technology. Although NATO was –and still is– first and foremost a defence alliance, at the height of the Cold War it became one of the chief promoters of joint research enterprises among its member states. This paper aims to explore the reasons behind this promotion in order to better characterize the notion of science diplomacy. In particular it recalls the role of scientific collaboration as 'backchannel' or 'track-two' diplomacy at NATO as scientific partnership was evoked especially when the relations between member states became tenser; primarily in an effort to overcome diplomacy crises and restore unity. The paper thus shows how this agenda gave orientation to the NATO science programme, also materializing an interesting shift. While, expectedly, the alliance promoted traditional defense-oriented research from the late 1950s, it ended up, surprisingly, sponsoring environmental studies in the 1970s. Did the NATO cold

warriors suddenly aspire to become eco-warriors? The paper ends up showing that they simply viewed the environment as congenial to improving NATO's fraught relations.

Science Diplomacy; NATO; environment; scientific collaboration; Cold War

First doctor in mathematics science in Brazil: Manuel da Cunha Galvão

Siqueira Martines, Mônica de Cássia, Universidade Federal do Triângulo Mineiro

In this article, we report of the PhD research defended in 2014, referring to the first Bachelor of Mathematics to obtain the title of Doctor of Mathematical Sciences. Our search was driven by trying to understand the mathematics that was developed in the Doctoral Thesis submitted to the Military School between 1842 and 1858 in Brazil. However, to understand why this degree in Brazil, began a survey of the Royal Military Academy. We wanted to know how it was created, what changes have occurred over the years and how did the idea to award the degree of Doctor of Mathematical Sciences. Through the reading of decrees and laws of the Royal Military Academy and his reforms, we see a series of decrees that have updated and given new guidelines the Royal Military Academy at turning in 1839 in the Military School and in 1842 this school, established the degree Doctor of Mathematical Sciences. This year and the next, until 1846, the said school teachers received the title without any other requirement. With the publication of Regularization of September 29, 1846, they are given guidance to those wishing to obtain the title of Doctor. In this context we present Manuel da Cunha Galvão, who on December 22, 1847, delivered his doctoral dissertation Dr. José Gomes Jardim and, on 28 May 1848, received his PhD degree in the presence of Emperor D. Pedro II.

History of Mathematics; First Doctor of Mathematical Sciences; Degree of Doctor of Mathematical Sciences; Manuel da Cunha Galvão

Production and circulation of knowledge in Brazil during XVI and XVII centuries

Sonia Brzozowski, UFABC

Márcia Helena Alvim, UFABC

This essay consists in a qualitative research, through documentary analysis, in the letters written by Jesuit priests called Antonio Blasquez, João de Mello, Ruy Pereira and Pero Correa. These priests worked in Portuguese America during the 16th century and the letters are available in the Brasiliana Library. The participation of Jesuit missionaries in the process of production of knowledge in Brazil was very important, as well in the registers, and the circulation of knowledge among the Jesuit Order. The letters presentes evidence of 'exchange' of knowledge between the Jesuits and the Natives and the circulation of knowledge produced from this relationship. The Jesuits letters allow us understanding medical knowledge systematization and also were a web of exchanging this information and medicinal products. The purpose of this essay is analyze how the Jesuit priest had took for them the Brazilians Indians knowledge during the colonization process. As consequence, producing a large list of medicines and new medical methods. It also aims to analyze the path which knowledge produced in Portuguese America circulated between continents. During XVI century Brazil received members of "Companhia de Jesus", with the propose to put into practice the a Native catechization project, the first Jesuit priests arrived at brazilian land in 1549, and they are responsible for most of registers, these registers was made using diaries of expedition and letters sent to their superiors, called "Cartas Avulsas". In summary, this study intends to: a) present documentary elements that discuss the production and circulation of knowledge in Brazil during the XVI and XVII

centuries, and also that Natives were part of this process; b) the priests's medical knowledge as a strategy of natives conversion; c) to emphasize the commercial interests of Portuguese people also on medicinal herbs; d) the substances found in the Brazilian fauna and flora were inserted in the pharmacological productions of the European pharmacies during XVII century.

Jesuit, native, knowledge

The History of Chemistry in Brazil as a methodological proposal for Chemistry Teaching starting with the contributions of Vicente Seabra da Silva Telles to the Chemical Nomenclature

Stephany Alice Pereira Monteiro, Universidade do Estado do Pará

Elizeu Antonio Portal de Moraes, Universidade do Estado do Pará

Maria Dulcimar de Brito Silva, Universidade do estado do Pará

André Silva dos Reis, Universidade do Estado do Pará

In the 18th century, the Brazilian economy was marked by the demand for extraction of natural products, and this demand brought a set of chemical operations that required technical knowledge (OLIVEIRA; CARVALHO, 2002).

Therefore, in this time, Brazilian chemists stood out by their pioneering studies related to chemistry. The History of Chemistry in Brazil (HCB), when well researched and focused on Chemistry Teaching, aims to work in a contextualized way the topics of the subject, demonstrating how its construction was made, its precursors and theories that grounded them (FERREIRA, FERREIRA, 2010).

Thus, we looked for approach the Chemical Nomenclature (CN) topics, using as reference the Brazilian chemist, Vicente Seabra, who was responsible for the translations of the new chemical nomenclature developed by Lavoisier to Portuguese Language, and it was because of this that today we can use the Latin etymology in the construction of compound nomenclatures and chemical elements. (FARIA; DEROSI; FREITAS-REIS, 2015). In this way, a workshop proposal named "The contributions of Vicente Coelho de Seabra Telles to the chemical nomenclature", where it approached: 1º- Lavoisier's subsidies to modern chemistry, once that in the Eighteen Century new compounds and techniques were emerging, and a universal language was needed to spread such knowledge, 2º- The contributions of Vicente Seabra, mentioned above, and 3º- A playful activity titled "INORGANIC DICES" to fixate the concepts of CN. The workshop was developed with undergraduate students in Chemistry from the Pará's State University, where we proposed a methodology to work HCB focused on CN teaching. When the students were asked if the HCB provided an understanding about the topic, we obtained the following reports: "Yes. It has made Chemistry and its study more dynamic and interactive," Student C. "Yes. For it has been found that the content is simpler and easier to understand," Student M. "Yes. I realized that the nomenclature did not come ready, that there was a construction of knowledge", Student B. In this way, concludes that when we relate the HCB with a chemical topic we provide a contextualization based on the historicity of the subject, demonstrating that teaching can be dynamic, having a greater understanding about the contents, promoting learning for the teachers and students.

History of Science; Chemistry Teaching; Chemical Nomenclature

Global Population. Kant and Alexander von Humboldt on Natural and Human Diversity

Susanne Lettow, Free University Berlin, Margherita-von-Brentano Centre

The history of demography and population politics is usually traced back to Malthus and eighteenth-century political economy while the link between political economy and natural history which is constitutive for the modern notion of the population has been mostly discussed with regard to the interrelations between Malthusian and Darwinian ideas in the late nineteenth century. In this paper I argue that the debates on human and non-human natural diversity that took place among naturalists and philosophers at the turn of the eighteenth to the nineteenth centuries also played a central – although widely neglected – role for the constitution of the notion of a „world population“. My analysis focuses on two authors from the German context, i.e. on Immanuel Kant's lectures on Physical Geography and his essays on race, and on Alexander von Humboldt's project of a geography of plants which relied on central insights from Kant's critique of traditional natural history. I reconstruct how both authors conceptualize diversity and unity with regard to humans, and how they situate human diversity within non-human natural diversity. Although their reflections are not restricted to living nature but, on the contrary, highlight the meaning of geological and geographical circumstances, the analysis of Kant's and Humboldt's accounts of natural and human diversity also contributes to an archaeology of the notion of biodiversity.

human diversity, demography, biodiversity, natural history, nature philosophy

How describe the history of technology – in case of electric and magnetic telegraph in the 19th century

Tadaaki Kimoto, Tokyo Institute of Technology

How to describe history of technology, what to explore in history of technology, and what to derive from history of technology is a critical methodological problem of historiography of technology. This problem has been discussed and aimed to integrate the internal and external method of history of technology from the early time of the establishment of the discipline.

Since Pinch and Bijker described the development of bicycle from the viewpoint of the relationships of the user to the bicycle, it, however, seems that the social constructivism, which thinks that social factors regulate the existence form of the technology, has become the most dominant current in the history of technology.

Without consideration the context, i.e. internal component of technology, however, historical significance of the technological change at each epoch of its development could not be explicated. How to integrate the internal and external factors of the technology is still a critical problem in the historiography. This paper discusses how to describe the history of telegraphy as for an example of this problem.

As it is well known, after the age of semaphore telegraphs in European countries electric telegraph devices, such as Soemmerling's Telegraph apparatus, Lomond's Apparatus Le Sage's apparatus, Salva's spark Telegraph, and then Gauss' and Weber's, and thereafter Cooke's, Wheatstone's, finally Morse' Telegraph, were invented. Each of these inventions are already well investigated.

In spite of the technological details of each inventions and many detailed histories of telegraphy, however, we have no sufficient history of telegraphy integrated internal and external factors. Just enumerating the facts does not make history. What kind of factors led to development of telegraph? Therefore, even the historical significance of Morse's device has not been elucidated. It has been only said that Morse has played a big role. But the question of why is not answered sufficiently. It remains yet many questions.

This paper discusses and shows the methodology of telegraph, what kind of factors played in the process, and how history of technology should be depicted.

methodology; internal history; external history; telegraph

Francisco Luís Pereira de Sousa (1870 – 1931), a Portuguese 'everyday man of science' in the beginning of the 20th century

Teresa Salomé Mota, Centro Interuniversitário de História e Filosofia da Ciência

The present paper concerns the scientific life of Francisco Luís Pereira de Sousa (1870-1931), a Portuguese military engineer that transformed himself into a geologist. Pereira de Sousa worked most of his life in the Portuguese Geological Survey and he was also a professor at the Faculty of Sciences of the University of Lisbon. He travelled frequently to Paris where he worked in the Laboratory of Mineralogy of the Musée d'Histoire Naturelle and he was mostly influenced by the theories of François Antoine Alfred Lacroix (1863-1948) and Eduard Suess (1831-1914) on tectonics. Pereira de Sousa made use of some of the concepts developed by those geologists in his own research, applying them to the geology of the Portuguese territory, namely on his hypothesis on the Lusitanian-Hispanic-Moroccan oval-shaped basin. If we approach Pereira de Sousa scientific life as a 'biography in context', it is possible to shed some light into the daily routine of an 'everyday man of science' in Portugal in the beginning of the 20th century, whilst enlightening questions related to the circulation and appropriation of geological knowledge in the country.

Geology; Biography; 20th century; Portugal

Narrating Place, Narrating Science: Literature of urban life and discovery

Thomas Kohlwein, University of Vienna

Cities are tapestries of narratives, inspiring all aspects of life, both literary and scientific practice. Drawing from research conducted for a literary anthology on the history of Vienna's universities and libraries, this paper intends to discuss how daily life in the city and everyday work on science, technology and medicine are interwoven.

In this literary approach, narratives connected to places in the city with a connection to science are collected. While grand buildings like hospitals or national libraries figure prominently in public imagination, other places connected to scientific work are much less known.

Examples of inside and outside perspectives show how the city is a place where these two overlap: patients and doctors, library patrons and scientists all have their stories attached to the same buildings and neighborhoods. For some it is the place they get in touch with science for the first time, for others their usual working place while they draw inspiration from other everyday places nearby. Fiction, memoir and even reports give glimpses of moments when ideas are formed.

Stories can draw a connection between scientific community and the broader public. Studying how narratives of science, technology and medicine are represented in urban literature could contribute to the debate on the role of place in scientific work.

Urban life; Architecture; Literature; Memoir; Fiction

Metabolic Spaces: Kisho Kurokawa's Vision of the Future Megalopolis and its Biotechnic Culture

Tobias Cheung, Institute of Cultural History and Theory, Humboldt-University

"Metabolism. The Proposals for New Urbanism" is the title of a manifest of five young Japanese architects – Kisho Kurokawa, Kiyonori Kikutake, Masato Otaka, Fumihiko Maki, and Kiyoshi Awazu – for the World Design Conference presented in Tokyo in 1960. In this paper, I would like to focus on Kurokawa's vision of a "metabolic space". Kurokawa defined this space as a hybrid order of biological and designed interaction between agents and built milieus. According to Kurokawa, the global task of architects is to transform the logic and order of living things and of their life-worlds into man-built spaces and their various devices and installations. Living architecture and the architect as an engineer of life – these are two key themes in his writings. Bodies, houses and cities are in Kurokawa's terminology all cell-like simple or composed organized 'capsules' with embedded codes that generate specific orders of interaction. Streets, highways and railroads as well as escalators, corridors and halls represent the mediating elements that combine the capsule-elements on different scales and levels with various environments. However, as a social engineer and urban planner, Kurokawa also considered the specific local cultural settings of life-worlds, for example the relations between Christian or Buddhist belief systems, architecture and biotechnic cultures within Eastern and Western societies. Through the reconstruction of Kurokawa's vision, it is thus possible to unfold a complex interrelationship between society, culture, technology and religion between the global and the local.

Metabolism; Agents; Biotechnology; Built space; Life-Worlds

'The Future Chamber of Investment Horrors': Critics of the British nuclear reactor industry, 1954-1979

Tom Kelsey, King's College London

Global histories of science have been productive, but it is still worth telling national stories. In part because the nation state remained a crucial entity for the funding of science in the twentieth century, but also because older stories about the place of science in certain nations need to be rethought. Historians have told very different stories about the place of science inside Britain and the United States. An older historiography on modern Britain argued that its political elite was peculiar for its distain towards science. In contrast, historians still argue that the American political establishment was supposedly beset by a naïve enthusiasm for science in the post-war period. Building on scholarship that has rejected these influential narratives, this paper suggests it was post-war Britain, not America, that lacked vigorous and public criticism of state-funded science. This paper considers the example of the British nuclear industry and follows its key critics both inside and outside of government from the mid-1950s up until the late 1970s, whilst tracking how the debate on nuclear power developed in the United States. There was always less criticism of nuclear power in Britain than in America. Yet, the British public had more cause for complaint. American designed reactor dominated the international markets, whilst British nuclear technology met with little export success. A powerful technological nationalism in Britain both ensured the survival of its reactor industry and helped to limit criticism of it. The few public critics of nuclear power industry in Britain were dismissed. Secrecy also limited dissent. There was a powerful and vocal opposition to the scale of the British nuclear power programme within the state, but it was hidden from the public discourse. Politicians repeatedly championed Britain's nuclear reactors, whilst often privately accepting the superiority of American nuclear industry. The public debate on nuclear power in Britain did grow in the 1970s. However, it also moved away from the specific issues of the British nuclear industry towards more general problems of atomic energy. The result was the problems that beset the British nuclear power industry, in particular, remained little discussed.

The Alchemical Tradition from the point of view of a group of 19th century pharmacists in Brazil

Verônica Pimenta Velloso, Instituto Federal do Rio de Janeiro

The identification of the magical tradition (natural magic) as one of the sources of knowledge that influenced the process of what was called the scientific revolution in the European world, was the reason for many debates in the historiography of science. Traditional historiography by overestimating the rational sense of modern science disregarded the mystical dimension in the process of its configuration, as George Sarton's studies. On the other hand, several historians stand out in the defense of the importance of studies from the Corpus Hermeticum in the Renaissance period, in order to understand the transformations that have taken place in the formulation of new conceptions about nature such as Paolo Rossi, John Henry, Allen G. Debus. Among this corpus, the alchemical tradition is always mentioned, standing out as an experimental activity that relates practical chemistry to medicine, represented mainly by Paracelsus (1493-1541) and his followers. These studies undid the image of science often made by the historical subjects themselves, representatives of this new natural philosophy, who disqualified the alchemical traditions, though many of them had drunk from these same sources. Such discussions resurface in the process of institutionalization of the pharmacy linked to medicine in the Imperial Court, capital of the Empire of Brazil, between the years of 1850 and 1880. From the text of the Italian opera *Elixir de Amor* by Gaetano Donizetti, staged in the city of Rio de Janeiro in the middle of the nineteenth century, one can perceive the appropriation that is made of its plot by a group of pharmacists and physicians gathered in their own associations. The name of the main character of the opera - Dulcamara (medicine of vegetal origin used at the time) is attributed several meanings related to charlatanism and witchcraft, identified with the practice of homeopathy and other practices and informal knowledge, which spread in Rio de Janeiro. The research with periodicals belonging to the great press (*Jornal do Commercio*), and those of the pharmaceutical and medical associations (*Revista da Sociedade Farmacêutica Brasileira*, *O Anti-Charlatão*) reveals the appropriation of the derogatory tone of the alchemical tradition as arguments to justify the monopoly of their practices in the day to day to the detriment of informal actions and knowledge in the Imperial Court.

alchemical tradition; pharmaceutical associations; Rio de Janeiro; historiography of science

Astronomy and Literature in Chile: Dialogue and discussion in the public space (1880-1930)

Verónica Ramírez Errázuriz, Universidad de Chile and Universidad Adolfo Ibáñez

The work study is about the relationship between astronomy and literature in Chile during the late nineteenth and early twentieth centuries. This relationship consists in a continuous dialogue -which tends to discussion- between scientists and writers, presented in the press, and driven mainly by their different interpretation and explanation of natural phenomena.

The proposal is that, throughout the process of institutionalization of astronomy in Chile, there was a period (1880-1930) in which this science significantly interacted with literature, because both disputed the same public space (the press) to transmit interpretations of the same phenomena from different perspectives. While scientists tried to inform and explain astronomical findings based on the evidence and also spread this knowledge to the community, literary writers published books and

articles of various genres who questioned the credibility and accuracy of these scientific findings, while advocating an approach from a non-empirical perspective, starring imagination, fiction and mystery, shaping a speech of esoteric tone, closer to a pseudoscience.

In this paper we demonstrate the importance of the press as a public space or stage that defines and marks the relationship between science and culture in the late nineteenth century and early twentieth century thought. In addition, we present the variants and details of dialogue and discussion between astronomy and literature through an analysis which merges two aspects: the historical study of the milestones that affected the drafting of texts, and rhetoric and poetic reading of the sources.

The paper reveals that for a certain period of the development of astronomy in Chile, its dialogue and discussion with literature was crucial in shaping the way this science communicated with society.

Astronomy; Literature; Public space; Science; Pseudoscience

From blogs to vlogs: the mediatization of science in 21st century Brazil

Verônica Soares da Costa, UFMG / Fapemig

Media is considered as a public space for discussion and legitimation of science, and the popularization of scientific knowledge has been intensified in recent years in face of innumerable possibilities of the digital social networks. Science is a field particularly affected by the broad process of mediatization that has been developed in recent years (HJARVARD, 2012, HEPP, 2014), understood as the influence of the media in a scenario that values communication and integrates different forms of technically mediated communication, crossed by different economic, social and political interests. Although initiatives to popularize science have existed in Brazil since the 19th century (MOREIRA and MASSARANI, 2002), it was in the early years of the 21st century that a national program for scientific dissemination began to be drawn in the country. Thus, the last decade is a fertile ground for the analysis of research projects and the spread of scientific knowledge in Brazil. Studies carried out by the author (COSTA, 2010) at the end of the first decade of the 2000s explored the ways in which individuals have explored the universe of blogs as tools for popularizing science.

The articulation of young researchers, journalists and curious people as a cohesive network of bloggers, in 2008, gave rise to ScienceBlogsBrasil, the largest blogging community on science in Brazil. On this platform, bloggers became active figures in the dissemination of important and relevant information, not only on their own works, but also on the scientific field in which they operate. Fagundes (2013) referred to this process as "cracks in the Ivory Tower".

Science blogs did not die, but in less than a decade they lost space to other digital social networks and platforms, especially YouTube and its monetization system. In this scenario, this proposal aims to recover data from the creation of a new platform, ScienceVlogsBrasil, a project that is gaining notoriety by gathering some of the most influential Brazilian Science YouTubers. By presenting an overview of the evolution of these projects as a means of disseminating science on the Internet, the proposal allows an analysis of the historical dimension of advances and changes promoted by digital social networks, as well as an understanding of how the public communication of science works on Brazilian YouTube, in comparison to foreign studies (WELBOURNE, GRANT, 2015).

mediatization; blogs; youtube; popularization of science

The internationalization of national energy research groups: network formation and political-scientific strategy

Victor Luiz Alves Mourão, Universidade Federal de Viçosa

Daniela Alves de Alves, Universidade Federal de Viçosa

Daniel Aparecido de Araújo Cabral, Universidade Federal de Viçosa

The internationalization of science and technology has been a subject of extreme relevance. This research project, still in progress, aims to produce reflexive knowledge about this process of internationalization of Brazilian research groups and scientific production. We propose to investigate the content of the agreements, the conflicts and interests that mobilize and are mobilized by these exchanges. We are guided by the perspective of Latour, for whom the work of the sociology of science is to follow the network traffic involved in the scientific activity, the actors, institutions, objects and people recruited within these networks. Our methodology aims to collect qualitative data mainly through semi-structured interviews guided by a script. The interviewees were selected from individual and collective involvement with international research networks in the area of energy. We also consulted research reports and their scientific production available on online platforms. The following hypotheses on international cooperation have been produced: (1) there is a cleavage between national and international scientific production, with different levels of legitimation and scientific recognition of researchers in regard to both poles, and a concentration of “periphery” activity in the training of human resources; (2) there is an internal process of intellectual extroversion, not just of external-internal scientific domination, in which the national groups and researchers themselves are structured in such a way as to unequally receive the foreign scientific production and agenda; (3) international cooperation has greater strategic content on the part of the center than on the periphery, which would produce an unequal process in terms of technoscientific and political results for each group and each country, also depending on the singularity of the area of knowledge and technological application of each area of knowledge. In the renewable energy sector, Brazil has played a leading role because of its abundance of raw materials and policies already developed in the past. Our interest is to understand how the international networks of the energy sector incorporate or relaborate Brazilian networks and actors, producing international alignments and misalignments, allowing the analysis to go beyond the diagnosis of the internationalization of Brazilian science measured only by the number of publications in other languages than Portuguese.

International research networks; energy; internationalization of science; sociology of science

Ovide Decroly: pioneer of the Belgian school of medical cinema?

Wagnon Sylvain, University of Montpellier

Is there a “Belgian school” of medical and scientific cinema? Through the route of the doctor-pedagogue Ovide Decroly (1871-1932), how to understand the specificity of its scientific approach and the circulation of scientific ideas from these experiments of scientific cinema. Indeed, the neurologist has, from 1907, used the cinema as a tool to serve his scientific experiments and like a means of diffusion of his medical discoveries. This “scientific” use of the cinema places the Belgian doctor and pedagogue as pioneer of the scientific cinema, in the line of Etienne-Jules Marey (1830-1904), Eugene Louis Doyen (1859-1916) or Arthur Van Gehuchten (1861-1914). On basis of the private archives of Decroly and the analysis of his films, we would like in a first part to specify the bonds, old and early between the cinema and science, to outline in a second part the bonds between Ovide Decroly within the Belgian society of neurology, which seems a crucible of his reflexions. Lastly, in a third part, we would like to analyze the characteristics of the scientific cinema of this Belgian school of medical cinema.

A comparison among astronomical indigenous constellations obtained in a field research and some historical ethnographic sources

Walmir Thomazi Cardoso, Pontifícia Universidade Católica de São Paulo /PUC-SP

The aim of the present work is to show a comparison among survey practical sky observation activities and on classical sources about indigenous constellations observed on Brazil's Amazon region. We accomplished a sky mapping of these indigenous ethnicities: Tukano, Dessoano and Tuyuka. From the description of many constellations we created an astronomical events and climate calendar along with students from differentiated indigenous school Yupuri. Rain periods, drought, planting and harvesting are marked by the sunset and sunrise of the major constellations created by Amazonia northwest indigenous people. Non-indigenous materials were also analyzed mainly from the early 20th century researchers, who were present in the Brazilian Amazonas' state. A large amount of constellations described and presented in the past century researchers' texts remain observed in the sky and are still being formally taught in school environments of different indigenous schools (Cardoso, 2007). Students and teachers are unaware of the ethnographers' work which were in the region, allowing compile the description and purposes from one and practices of other. We developed a comparison among two books written by the Salesian priest Alcionílio Bruzzi da Silva (Silva, 1962; 1994), another research work from the early twenty century in a sixties edition (Koch-Grünberg, 1969) and our field research. There are some formal differences that draw attention regarding to sky observation purposes, symbols of the possible epistemological conceptions from the researchers. The methodological frame of this research employs historical ethnographical sources and Astronomy in Culture. Astronomy in Culture is an expression used since early last decades' beginnings to describe cultural perceptions and understandings of astronomical phenomena in a cross-disciplinary field. History of Astronomy and Astronomy in Culture were both central in this work to understand old and recent indigenous constellations descriptions and its implications on Amazonian traditional cosmological conceptions.

Astronomy in Culture; Indigenous Calendar; Ethnographic sources; Indigenous constellations; Non-occidental science

The Technological knowledge of Karez from Xinjiang

Wei, Chen, Institute for History of Natural Sciences, Chinese Academy of Sciences

The karez (or Qanat in Arabic) is a kind of irrigation system utilizing underground water in arid or semiarid area. Most of scholars believe the karez originated from the areas around the Persian Gulf (modern Iran or Oman) and spread to many parts of world in several thousand years.

In China, more than 1000 karez are found in Xinjiang Uyghur Autonomous Region, especially in Turpan Basin. From recent but informal investigations, some evidences suggest that the karez had appeared in Turpan no later than 8th century A.D. In fact, most of existing narratives about Chinese karez focus on the relationship between Xinjiang karez and some irrigation systems in hinterland of Chinese culture, many of which are full of misinterpretation on philology. However, up to now, there is rare study paying attention to the technology knowledge containing in the karez sees as an aggregation of knowledge with complicated context. Therefore, it is difficult to compare the karez in details from Xinjiang with other cultures.

To study the Xinjiang karez, the anthropological field work is necessary. The author tries to follow

one group of Uyghur karez craftsmen, to explore the terminology of Xinjiang karez, the sensed knowledge in the determination and excavation of the canals, the institution of maintenance and distribution of the water flows. Base on this, the author would discuss the relationship and diversity of the knowledge about the karez from Xinjiang and other studied areas.

Karez; Xinjiang; sensed knowledge; institution of maintenance and distribution; intercultural compare

Research on the Science and Technology of White Porcelains from Ding Kiln of Ancient China

Weidong Li, Shanghai Institute of Ceramics, Chinese Academy of Sciences

Under the influence of Xing kiln, Ding kiln began producing white porcelain in the middle and late Tang Dynasty ((618-907 AD), and gradually emerged as the best producer of white porcelain during the Song dynasty. Ding kiln declined during the Yuan Dynasty (1279-1368 AD).

Using a series of scientific methods, this research studies the chemical composition, microstructure, firing temperature, physical properties, appearance features of the white porcelain samples from the 2009 archaeological excavation. The 188 samples selected in this study cover the entire time series of Ding Kiln from late Tang Dynasty to the Yuan Dynasty. By taking multiple perspectives, this study attempts to reveal fully the physical and chemical characteristics of white porcelain of Ding kiln as well as its development and evolution.

The scale, variety and circulation of Ding kiln products are considerable. White porcelain wares from Ding kiln long served as tributes for the Song imperial court, and as important commercial goods during the Southern Song (1127-1279 AD) and Jin (1115-1234 AD) Dynasties. Ding kiln has a profound impact on the subsequent porcelain making industry in ancient China. It embodies a series of important breakthroughs in porcelain making techniques. Kaolin, feldspar, quartz, dolomite, talc, occurring near the kiln sites can be used as the raw materials for the manufacture of the body as well as the glaze. This provides the material basis for the manufacture of high quality and refined white porcelain. Improvements were also made in kiln structure accompanied by the increase of firing temperature. The dome-shaped kilns have half-reverse flame, large and deep fire chamber, small kiln room, developed ventilation and large chimney. Along with the abundant wood or coal resources nearby, these kilns ensure the high temperatures for porcelain firing. Ding kiln in Northern Song Dynasty (960-1127 AD) invented the inversion firing method and the sagger assembled by stacked ring-supporters, to maximize the use of space and prevent ware distortion. These inventions improved the output and quality of porcelain. As a major technological innovation, this achievement played an important role in promoting the development of ancient China's porcelain industry. The world famous porcelain making site--Jingdezhen was profoundly influenced by it. White porcelain of Ding kiln is also noted for the decorative techniques including engraving, scratching and stamping.

white porcelain, Ding Kiln, Science and Technology, evolution, ancient China

Science for Whose Benefit? Funding for China's Development of Modern Science by the Rockefeller Foundation and the China Foundation in the 1920s and 30s

Wen Heng, Tokyo Institute of Technology

Through their funding activities, the Rockefeller Foundation and the China Foundation for the Promotion of Education and Culture contributed a great deal to China's development of modern science in the 1920s and 30s. An intriguing question is to what extent these achievements fulfilled

the two foundations' original goals. The ideal set by the Rockefeller Foundation for its enterprise in China had been modeled on the Johns Hopkins medical school, but that plan was carried out far from smoothly, and the Foundation had to extend its emphasis on medicine to natural sciences. Its diversifying activities in China during the 1920s made its original scheme ever harder to maintain, which was further severed by the increasing sympathy towards China's own situation on the part of its officers responsible for aiding natural sciences there. Roger Greene and Gist Gee's stance, which drove them away from the center of the Rockefeller Foundation's operation in China, was closely related to their parallel service for the China Foundation. Set up to manage American remission of the Boxer Indemnity, this foundation was dominantly governed by the Chinese who were more focused on the development of modern science in their own country.

If this configuration merely casts doubt on labeling the science supported by either foundation as systematically American, it certainly defies any America-centered narrative such as cultural imperialism in characterizing their activities in China. But even though these activities generally aimed at benefiting the Chinese, with limited resources at their disposal both foundations had to confront the question who, among China's massive population, should benefit first from their support for science. Their answers, constantly reshaped by their own respective observations and experience both in China and around the world, were less reflected in the organizations' rigid policies at headquarters but more in the agents' impromptu judgments in the field. By examining the actual conduct in China by the Rockefeller Foundation and the China Foundation, as well as the complexities in decision making carried into it, this paper attempts to see how each envisioned the role for science in China's ongoing modernization, and how such visions evolved against the changing conditions in that process during the 1920s and 30s.

modern science in China; Rockefeller Foundation; China Foundation; funding of science

The Business of Birth and the Politics of Place: The Surprising History of Modern Obstetrics

Wendy Kline, Purdue University

Recent media coverage of the increasing popularity of out-of-hospital births in the U.S. and Europe has generated a widespread debate about the politics and place of birth. Is it safer to give birth at home or in the hospital? Does modern technology and medical intervention utilized in hospitals improve or worsen birth outcomes? While there remains much disagreement, the 2014 British Birthplace study, which reviewed 64,000 low-risk births in different settings, suggested that the risks of over-intervention in the hospital may outweigh the risks of under-intervention at a birth center or home for healthy women. Yet most women today choose to give birth in the hospital. How and why did out-of-hospital birth come to be viewed as dangerous and undesirable? And how did the politics of place on the local level affect these practices? Many historians of science and medicine have tackled these questions and offered important evidence of the medicalization of childbirth and the growing influence of obstetrics in the 20th century.

Yet more work needs to be done. This conference paper will address the increasing bifurcation of birth practices in the mid twentieth century (home vs. hospital) by looking at the influential role of Dr. Joseph DeLee and his Chicago Maternity Center in promoting obstetrics. DeLee is one of the most influential figures in 20th century American obstetrics, and was determined to wrest control of childbirth from midwives to obstetricians. Yet he was also keenly aware of the value of exposing medical students to the natural process of birth that occurred outside of the hospital. His creation of the Chicago Maternity Center in the 1930s played a pivotal role in promoting the study of obstetrics – at home. Despite his desire to see childbirth move into a medical setting, he viewed home birth as a safe, cost effective, practical procedure in working-class Chicago. His desire to promote the home birth setting as an effective learning environment for medical students inadvertently provided justification for sustaining home birth practices in urban areas later in the twentieth century. The

ICHST
2017

data and arguments created by DeLee ultimately provided key evidence that later home birth activists would use to denounce the very shift to hospital birth promoted by DeLee.

childbirth; obstetrics; reproductive health; medicalization

The Sino-Britain Nuclear Proliferation at the Beginning of Cold War

Xiao, Liu, School of Humanities, University of Chinese Academy of Sciences

In the course that China developed her nuclear industry, two quite popular stories are, respectively, the nuclear blackmail from US and the technical assistance from USSR. Nevertheless, the scientific and technical relationship between UK and China in this field is often ignored, though in some particular cases this relationship played crucial rules. In the mid of 20th century, Sino-Britain had maintained a long-lasting cooperation. Although their scientific exchange served political and economic interests, the cooperation had conducted to the development of advanced military projects in the crucial period. The study traced a dozen of Chinese top-level nuclear scientists who had the experience in UK. The most famous figures were Qian Sanqiang(nuclear physics) and Li Siguang(geology). Then enumerated several special channels of Sino-Britain, such as WFSW, Pugwash Conferences, and Royal Society / Academia Sinica relationship in cold war background to show the proliferation of nuclear sciences between the 2 main powers.

nuclear physics; Sino-Britain relationship; nuclear proliferation, cold war

Cui Guoyin's Observation and Realization of Science and Technology Development in American in Late 19th Century

Xingguang Wang, Zhengzhou University

Cui Guoyin was born in Taiping(Huangshan city) in Anhui province and awarded the Jinshi degree in the reign of Tongzhi. The Qing Dynasty appointed Cui Guoyin to be the China's minister at USA, Hispania and Peru from the 15th year to the 18th year of Emperor Guangxu (1889-1893). Cui Guoyin objectively recorded politics, economy, military, diplomacy and life of the overseas Chines, and recorded in detail science and technology development in American in late 19th century in overseas travel notes of America, Hispania(Spain) and Peru, and we could find out development situation of natural science and engineering technology, such as astronomy, geography, chemistry, machinery, weaponry manufacturing, mining and metallurgy, energy, transportation, architecture, agriculture, water conservancy and etc. He deeply realized that the science technology development played an important role in American modernization and put forward some suggestions on studying advanced western science and technology, developing China science and technology and the way for the country to enrich itself and its people. Generally speaking, Cui Guoyin's travel notes had detailed content, trenchant foresight and original view, which showed his feeling for caring for the country and the people and ambitions of serving to the country as a diplomat. It was worth paying attention and studying.

Cui Guoyin; Science and Technology; 19th Century; Qing Dynasty

Weather Observer Henry Batson Joyner – England, Japan, and Brazil –

YAMAMOTO Akira, Meteorological Research Institute, Japan Meteorological Agency

Henry Batson Joyner was born July 9th, 1839 as eldest son of Henry St. John Joyner, of Northwick, Harrow, England. The father, St. John Joyner was a tenant farmer, occupying 1000 acres of land and also he was a dedicated citizen weather observer. Some reports about remarkable events were published in “Symons’s Monthly Meteorological Magazine”.

Batson served as an engineers of railways and a resident engineer of a town to 1870, in which year he left England to take up an appointment under the Imperial Government of Japan, being employed first in the Public Works Department, in the construction of the earliest railway in Japan. He carried meteorological instruments including a raingauge and a thermometer, presented by English donors and preformed weather observation at Tokyo for two years and send reports to England. They were also published in “Symons’s Monthly Meteorological Magazine”. After that he got a chance to establish the national meteorological service of Japan, present Japan Meteorological Agency. He trained and instructed the native students in a thorough knowledge of that science and laid the solid basis on which the service system was built up.

He left Japan in 1877, and after a short stay in England, proceeded at the latter end of 1878 to Sao Paulo, Brazil as Engineer in-Chief for the planning and construction of the extensive water supply and sewerage system of the city. He also performed weather observation there for five years and send reports to England Meteorological Office. But it didn’t lead the national meteorological service of Brazil. Further studies about the details of the observation, including the instruments, the siting, supporters, should be needed. On the completion of his works as Engineer in-Chief in May 1884, he returned to England hoping to recruit his somewhat impaired health, but got worse and died on the 23rd of November, Summary of the observation at Sao Paulo was published in “Quarterly Journal of the Royal Meteorological Society” after his death.

weather observer; Henry Batson Joyner; national meteorological service; Japan Meteorological Agency; Sao Paulo

The Doomed Failure of Westernization Movement-the improved opinion about Li HongZhang’s “miss the boat”

Yang Aihua, School of Humanities and Social Sciences, National University of Defense Technology, Changsha

Liu Yanqiong, National University of Defense Technology

As an epoch-making weapon which had altered warfare mode, Maxim-Machine-Gun played an important role in process of military technology’s development. Unfortunately, had been intensely criticized by later generations, the Westernization Group led by Li HongZhang were blind to purchase this weapon. However, through the collation of relevant historical documents, this research verifies military industrial enterprises of Westernization Movement did hold the independent capacity of producing this weapon. Invented sooner than Maxim-Machine-Gun, the Gatling-Gun was also come into widespread usage by the Qing Dynasty. And the very reasons which made Li HongZhang give up purchasing Maxim-Machine-Gun were not only the complicated manufacturing process and the outdated military thoughts, but also the backward management, low-technology and insufficient fund of Westernization Movement.

Maxim-Machine-Gun; Westernization Movement; Li HongZhang, weapon properties

Where did Guo Shoujing make the gnomon shadow measurements for the determination of the Winter Solstice in the Shoushi li?

Yao Xiao, School of Humanities, University of Chinese Academy of Sciences

For the determination of the winter solstice in the calendar making, Guo Shoujing made important innovations in the measurement of the gnomon shadow lengths, including the invention of the Shadow Definer and the construction of the large gnomon of 40 chi high. The Yuan shi recorded 98 measurements with the 40-chi-high made from 1277 to 1280. Our analysis of the data shows that these measurements were made in two locations, one corresponds to the location of the Imperial Astronomical Directorate of the Yuan Dynasty, which is near the present day Beijing Ancient Observatory, the other correspond to a location about 2 minutes further to the south in latitude, or about 4 kilometers in distance. We suggest that this latter location might have been where the Imperial Observatory of the Jin Dynasty (1115-1234) were located. Apparently, before the establishment of the Yuan Imperial Astronomical Directorate in the Great Capital (the present day Beijing) in 1279, Guo Shoujing used the old Jin Observatory for measuring the gnomon shadow lengths. Those data for the time period before 1279 fit the location of the Jin Observatory better.

Guo Shoujing; shoushi li; Gnomon shadow measurement; location

Hygiene, progress and modernization. The vision of electricity in the introduction of tram and electric lighting in Santiago de Chile, 1890-1910

Yohad Zacarías, University of Chile

The electrification was an integral part of the urban modernization of Santiago, which developed in parallel with Chile's insertion in international capitalism. From this perspective, the arrival of tram and electric lighting was the fruit of political decisions from the Municipality and Congress, based on positive perceptions associated with electricity. These perceptions were supported, in the case of the tram, in the conception of the unhygienic of the horseback. In the case of lighting, the practice was to centralize electricity privileging zones and streets, based on the idea of the progress that technology possessed for the modernization of the city.

The tram and electric lighting were related to its energy matrix. The electricity reunite all ideas of industrial rationalization, becoming the principle used by parliamentarians, builders and engineers, who thought that electricity would bring an immediate increase in productivity. To study this process, I analyze the political decisions that gave rise to the introduction of the electric tram, establishing networks between State formation and the history of the social construction of technology.

The importance of studying the process from the formation of the State contemplates two aspects. On the one hand, is very useful to define historically the beginning of the centralization of the public regulation of electricity. On the other hand, is meaningful to explore the idea of the modernization that in Santiago had to come. This idea of modernization can be study with the history of technology, specifically with theories about the social construction of technology.

The notion of competence is used in the actor-network theory, where the fundamental thing is to follow the technological artifacts deploying competences, which would be the fruit of the uncertainty generated by the objects. For this presentation, the competencies in the confrontation is between the tram and the electric tram, and between gas lighting and electric lighting. These ideas about electricity would tend to stabilize, since perceptions from local elites associated electricity with material progress, necessitating their consumption and use. Thus, stabilization would emerge in a consensus on what electricity meant, redefining its use.

Hygiene; electricity; State; late nineteenth century; modernization

Making colors mathematical: Isaac Newton's struggle on the experiments

Yoshimi Takuwa, Kobe University

Isaac Newton always had an ambition to make the science of colors mathematical. We catch only a glimpse of his ambition in the *Opticks* (1704), however, he revealed his strong intention of “treating colors mathematical” and “expanding the boundary of mathematics,” in the letter to the Royal Society of London (though this part had been deleted when it was published in 1672), and in the *Lectiones Opticae* (1729), which had been unpublished during his lifetime. As Newton said, the science of colors was thought to be a part of physics, and optics, namely traditional geometrical optics, was thought to be a part of mathematics. Newton, who discovered that both colors and refrangibility are the properties of light, faced the mission of combining colors and optics.

To make colors mathematical, Newton defined that his new theory is proved by experiments. That is to say, his experiments are different from Baconian instances “to enrich natural history,” but precisely set up to convince readers that propositions of colors are proved “mathematically.” Newton used the axiomatic method to write down his optical works following the traditional style of geometry, and at the same time, made his experiments quantitative.

The first purpose of this study is to describe that his quantitative experiments were not so much convincing for his opponents, backed up by tracing the controversy in the seventeenth century, and by doing simulations and replications of his experiments. For scholars such as Robert Hooke and Christiaan Huygens, the style of Newtonian writing was in question. For scholars such as Anthony Lucas and Edme Mariotte, the reproducibility of Newtonian experiments was in doubt. As for the second purpose, by looking into optical works of the next generation writers, such as Robert Smith and Joseph Priestley, I would like to investigate whether Newtonian style of writing was succeeded by them, and whether his ambition to unify colors into optics was achieved or not.

Isaac Newton; optics; mathematics; physics; experiments

The Anthropic Principle and the Cosmological Constant Problem

Yumei Wu, School of Humanities, University of Chinese Academy of Sciences

In order to gain a static cosmological solution, Einstein introduced the cosmological constant in his theory of general relativity. Hubble's discovery of expanding universe suggested that this constant could be eliminated. However, new observations in 1990s indicated an accelerating expanding universe, which is in favor of the existence of the cosmological constant. Since the late nineteen eighties, the anthropic reasoning has been introduced to resolve the cosmological constant problem, and raised many discussions which were not only involved with the front problems of modern cosmology, but also related to some nonscientific problem such as how the scientists community refuted or accepted a theory as a scientific theory. This paper studies how the anthropic principle is used by scientists such as Steven Weinberg, A. Linde, and Stephen Hawking to approach the cosmological constant problem. Weinberg's paper “Anthropic Bound on the Cosmological Constant”, which appeared in *Physical Review Letters* in 1987, changed the nature of the cosmological constant problem fundamentally. Why cosmological constant is so small compared with the observations, and why exists so large a discrepancy between theory and fact, of the order of 60–120 magnitude? This led some cosmologist to propose such theories as cosmic fine-tuning and multiverse. Linde used the anthropic principle to talk about the selection from the universe-ensemble the one that suits the existence of human beings. For Hawking, the anthropic principle stimulated a shift in the way of tackling the cosmological problems: from the “bottom up” to

“top down” approach. Based on above cases, this paper finally discusses the philosophical implications concerning the nature of scientific thinking.

Antropic principle; cosmological constant; Fine-tuning; Multiverse

“So that we do not confuse one thing with another”: The cosmology of Cristoforo Borri between classroom and printing press

Zaqueu Vieira Oliveira, University of São Paulo

Giovana Massaretto da Silva, São Paulo’s State Government

In 1629, the Lisbon presses of Matias Rodrigues finished printing the cosmological treatise *Collecta astronomica* by the Milanese Jesuit Cristoforo Borri, who had been stationed in Portugal for a few years, after returning from a long missionary sojourn in Southeast Asia. Though approved by the Holy Office and the Bishop's censors, the book still had to wait almost two years before appearing on the market, due to a delay in being granted the Society of Jesus' internal license. By 1631, when it finally went out, Borri had already left Portugal for Madrid and then Rome, where he was to die in early 1632. In a letter to Jesuit General Muzio Vitelleschi, written before his departure from Portugal, Borri complained of the troubles he was having to get the work approved, adding, however, that lately he had been able to teach its main contents unimpeded. Indeed, besides the usual exposition of basic astronomical concepts and phenomena, the work espoused a Tychonic view of the world-system, which was quite current among late-1620s Jesuits. Two student notebooks of his lectures at the Jesuit College of Sto. Antão, in Lisbon, delivered around 1627 or 1628, in fact testify to this, and give credit to his hints that what was hindering publication was related to personal quarrels with important local members of the Society. Thus, as evidence suggests, we conjecture that publication may only have been possible due to the patronage of the Count of Villa Nova and the King Philip IV. Be it as it will, the notebooks and the printed treatise reveal that Borri's Tychonianism was highly particular, adding original details to the general geo-heliocentric. Two important modifications introduced by him are the proposal of a spiral planetary motion, and a detailed “dynamical” theory of planet-carrying angels. By examining his teaching records in comparison with the printed book we suggest he employed subtly different explanatory and rhetorical practices in each setting, gauged to the different audiences. The lecture notes explicitly simplify some aspects of his theories, with the declared purpose of avoiding “confusion”, while the book delves deeper in technical aspects and in enlisting supporting authorities. Although confined to the specific case of Borri, we finally consider ways in which possible differences in teaching and writing practices by members of the Society may be assessed in general, as well as point to the importance of considering Jesuits' patronage strategies.

Cristoforo Borri; Cosmology; Jesuits; College of Sto. Antão; Patronage in Science

“No Science, No National defense” — national defense science movement in China in World War II

Zhang Jiajing, University of Chinese Academy of Sciences

In 1941, the Chinese Anti-Japanese War entered into a stalemate; Chiang Kai-shek put forward a slogan “No Science, No National defense; No national defense, no country”, which officially promoted the national defense science movement.

This is a movement to popularize science, which is planned and organized by the government. Various local governments actively responded to it. Many scientific clubs took actions to call on

scientists to join in it.

This movement takes the main form of holding science fairs, science performance and scientific paper competition, translating new knowledge of European and American national defense, and setting up special awards of national defense, so as to propagate and popularize the scientific knowledge of national defense. Governments at all levels and civic institutions reacted enthusiastically and actively joined to promote the national defense science movement. The National Defense Science Institute in 1943 and the National Defense Science Fair held in Chongqing in 1944 represented the culmination of this movement.

This movement, combined with improving the national defense, has three important impacts on the development of science at that time. First of all, the knowledge of science about the national defense was popularized among ordinary people, who realized the power of science in war, and the basic scientific literacy of them was improved in a way. Secondly, the government, influenced by the campaign, strived to develop the national defense science. Thus, the development of science in China at that time placed a particular emphasis on applied disciplines and neglected basic disciplines. Thirdly, it triggered a fierce discussion on scientific ethics among scientists and scholars, who started to rethink the negative effect of science.

science in wartime, science and politics, national defense science

Science-Diplomacy: A British Scientist's Activities in Wartime Chongqing

Zhang Li, University of Chinese Academy of Sciences

Zhu Yanmei, University of Chinese Academy of Sciences

In the summer of 1941, British biochemist Joseph Needham (Joseph Terence Montgomery Needham, 1900-1995) was appointed by British Council the curator of Sino-British Science Cooperation Office set up in Chongqing, in the name of a councilor. In the early spring of 1943, Joseph Needham arrived at Chongqing – the capital of Wartime China. As a diplomat, he traveled 30,000 miles across China from 1943 to 1946, during which time he investigated research activities of Chinese scientists as well as scientific research institutions and participated in the related work of British Council at the same time. According to the relevant materials about Joseph Needham collected in both University of Cambridge and Chongqing Archives, the paper analyzes the role a scientist has played in the Wartime Sino-British relations and diplomatic relations between China and other countries.

Science; Diplomacy; Joseph Needham; Chongqing

Did Soviet Union be intended to provide backward technology? A study on the China Choice process of nuclear reprocessing technology in 1960s

Zhihui Zhang, University of Science and Technology of China

Pei LIU, Department of History of Science and Archaeology, University of Science and Technology of China

Nuclear reprocessing technology was developed to chemically separate and recover fissionable plutonium from spent nuclear fuel. Originally, reprocessing was used solely to extract plutonium for producing nuclear weapons. With the commercialization of nuclear power, the reprocessed plutonium was recycled back into reactors. Nowadays, only a few countries grasp this cutting-edge technology for high radiotoxicity, huge recovery of plutonium (>99.5%) and critical safety. In 1956, as soon as it launched its nuclear weapon program, China began exploring possibilities for

military reprocessing with the Soviet aid. The reprocessing technology provided by Soviet was based on precipitation of slightly soluble sodium uranyl acetate, $\text{NaUO}_2(\text{CH}_3\text{COO})_3$ from nitric acid solutions containing dissolved uranium fuel. The 10th Research Division of Atomic Energy Institute (AEI) was set up as a special research organization to master precipitation method. After the Soviet stopped its aid in 1960, China began to study and reevaluate the precipitation method. The Second ministry of Machine Building Industry made alternate plans in Liu Yunbin's proposal, the director of 10th Research Division of AEI. Plan A was to continue the verification of precipitation method in 10th Research Division of AEI and Plan B was to make an exploration and research on the advanced Purex method developed in the United States by Tsinghua University. After repeated demonstrations and arguments, China finally abandoned the precipitation method and switched to Purex at the end of 1964. The results of hot test performed parallelly by AEI and Tsinghua University showed that the Purex method was feasible. The technology and its application in nuclear fuel reprocessing plants made China one of the leading countries in this field throughout the world.

Some experts have blamed the Soviet provided backward technology that made China take a detour in early stage. This view is echoed by famous Chinese historian Shen Zhihua, because it seems reasonable to consider that the Soviet Union has some reservations from a logical deduction. In this paper, it demonstrates that the Soviet Union did not be intended to provide backward technology.

Nuclear fuel reprocessing; Soviet's aid; precipitation method; Purex method

From Ivory Tower to Doing Business—The Development of the First Start-up Company in Chinese Academy of Sciences Between 1980s and 1990s

Zhihui Zhang, Chinese Academy of Sciences

During the early days of the reform and opening up since 1978, the planned economy was shifted towards market economy. Guided by the demand of the central leadership to steer science and technology towards national economy, the Chinese Academy of Sciences (CAS for short) pioneered in scientific research system reform by starting high-tech companies. Kehai Company and other early private technology startups took the initiative to explore the principle of "four-selfs" and an operation mechanism that combines "R&D, Production and Trade" during practice.

The practice of combining the CAS scientific achievement transformation with local economy set an example for the CAS and other high-tech companies in Zhongguancun. A "Zhongguancun Street", or the Chinese Silicon Valley, emerged quickly in the 1980s. The continuous improvement of national science and technology, supportive policy from Haidian District government, as well as CAS leaders like Zhou Guangzhao played an important role in this movement. Nevertheless, the dilemma of ownership system hindered the development of Kehai Company. Due to a failed attempt to carry out the shareholding system reform and to establish a modern corporate system, Kehai Company and other pioneering high-tech startups in Zhongguancun finally vanished from public sight in the wave of market economy in 1994.

It's worth mentioning that until now people are still debating that, whether the movement of Zhongguancun startups undermined the basic research in China, or was it a successful beneficial attempt?

high-tech startups, planned economy, market economy, scientific achievement transformation, Kehai Company

Science-Diplomacy: A British Scientist's Activities in Wartime Chongqing

Zhu Yanmei, University of Chinese Academy of Sciences

Zhang Li, University of Chinese Academy of Sciences

In the summer of 1941, British biochemist Joseph Needham (Joseph Terence Montgomery Needham, 1900-1995) was appointed by British Council the curator of Sino-British Science Cooperation Office set up in Chongqing, in the name of a councilor. In the early spring of 1943, Joseph Needham arrived at Chongqing – the capital of Wartime China. As a diplomat, he traveled 30,000 miles across China from 1943 to 1946, during which time he investigated research activities of Chinese scientists as well as scientific research institutions and participated in the related work of British Council at the same time. According to the relevant materials about Joseph Needham collected in both University of Cambridge and Chongqing Archives, the paper analyzes the role a scientist has played in the Wartime Sino-British relations and diplomatic relations between China other countries.

Science;Diplomacy;Joseph Needham;Wartime;Chongqing

True knowledge and moral certainty in Descartes' philosophy of nature

Zuraya Monroy-Nasr, Faculty of Psychology, National Autonomous University of Mexico

Descartes' definition of "scientific knowledge" is strict. It only admits what is certain and evident, in the sense of indubitable. True knowledge is characterized in this manner. Cartesian philosophy has been predominantly understood as radical rationalism. Nevertheless, in the last decades of the 20th century interpretations emerged recognizing the fundamental role of experience (and experiment) in Descartes' philosophy of nature and in his epistemology of science. Then, the pressing question becomes whether Descartes can maintain and justify true knowledge of the physical world or if he has to recognize that his physical science merely achieves practical certainty.

First, I intend to show that from its origins Descartes' natural philosophy stands apart from pure speculation and instead demands that scientific principles be tested. Even more, Descartes affirms that the more the knowledge advances, the larger the need for experiences that test its validity. Second, I will argue against interpretations on the gradual certainty in Descartes' philosophy of nature. D. Clarke has defended theses that try to support the idea that Descartes admits moral or practical certainty in his natural philosophy. Therefore, he would accept doubt and probable knowledge in this domain. I fully recognize we owe to Clarke the recognition of the role of experience in Descartes' philosophy of science. Nonetheless, I disagree with his vision of Cartesian certainty in science. Consequently, I argue that Descartes claims metaphysical certainty for knowledge of the natural world, and rejects probable knowledge in the domain of physical science. [PAPIIT IN 402515]

Descartes; philosophy of nature; true knowledge; moral certainty

The Global, Local and Universal: Tensions of Scale in Newtonian Natural Philosophy (1687-1720)

Zvi Biener, University of Cincinnati

Tensions of scale were central to the development of modern physics. This paper details two such tensions in early Newtonian natural philosophy and explores their consequences the emergent Newtonianism of 1687-1720. It shows how global approaches to knowledge arise not merely as

contrasts/complements to local ones, but as negotiation strategies, compromise points between the local and the *universal*.

The first tension concerns the conflict between the notion of a universal “Law of Nature” (newly popularized in the mid-17th century) and the stridently local knowledge-gathering strategies of Baconian members of the Royal Society (e.g., the making of natural histories, instances with special powers, etc.). I argue that the conflict between the universal and the local in natural philosophical methodology led to the creation of a more limited “global” concept of law, one that has been largely forgotten in the history of physics. For example, it allowed Isaac Newton to claim — in violation of the idea of “Law of Nature” we regularly ascribe to him — that God could “vary the Laws of Nature, and make *Worlds of several sorts in several Parts of the Universe*” (Opticks, 1718). Postulating global variation (in the face of local difference and in opposition to universal homogeneity) turns out to be the hidden engine behind some of Newton’s most famous methodological proclamations (e.g., the *Regulae Philosophandi*).

The second tension concerns the conflict between the purportedly universal character of the mathematics underlying Newton’s *Principia* and his claim that the truth of geometrical definitions depends on context and the aims of the mathematicians that formulate them. By itself, the latter claim is striking, and quite contrary to the philosophy of mathematics dominant in the late 17th century. Nevertheless, Newton made it repeatedly in manuscript sources. I argue that his conception of geometrical definition was used to carve out a space that transcended local relativism, but still fell short of the binding absolutism of the universal, in a way that mirrored the first tension described above, but concerning truth itself. Newton’s “global” definitions were used by him to ascribe binding, but fallible, truth to his new physics. This idea became central to 18th century Newtonianism and enabled its fruitful interaction with various empiricisms. Both tensions demonstrate how global strategies can serve as compromise points between the local and the universal.

Newtonianism; Laws of Nature; Geometry; Universalism; Baconianism

Papers in Symposia

001. Science and Literature: Global and Local Perspectives

Science and Religion in Greek literature during 19th-20th centuries

George N. Vlahakis, Hellenic Open University - Institute of Historical Research National Hellenic Research Foundation

Science and Religion is a field that has been emerged in the framework of History of science in 20th century. In the present paper we aim to study this relationship, direct or indirect, in the Greek literature of the 19th and 20th century. Our material will be novels and poems as well as popularizing journals of science which have been appeared since the modern Greek Enlightenment.

"Greece"; "science and religion"; "19th century"; "literature"; "20th century"

Literature, Science and God: The case of Flannery O' Connor

Georgia Pateridou, Hellenic Open University

This presentation aims to reexamine the work of the American writer Flannery O' Connor through the intersection of the major themes stated in the title: science and God. It will take into consideration her personal trajectory (the way her faith and her illness affected her writing) but will expand the discussion to include general remarks about writers of the second half of twentieth century. From her youthful work, *A Prayer Journal*, Flannery O' Connor acknowledged that 'writing' cannot easily become a prayer, a spontaneous overflow of a process that is given rather than cultivated. Her subsequent writing (literature and essays) retained –as a result of her faith or even as a constant effort towards attaining the best of her craftsmanship – a dynamic spirit of fighting coupled at times with a deep melancholy about the fate of humanity, a fate which the promises of science faltered to ameliorate to the extent expected by it. It is our belief that her case proves to be a fruitful example in order to explore the issues (strategies and techniques) employed by writers of her generation with similar concerns.

Flannery O' Connor, Science, Literature, Faith, Prayer

Science, Literature and Religion: Strange alliances and shifting enmities in fin-de-siècle Greece

Kostas Tampakis, National Hellenic Research Foundation

During the two final decades of the 19th century, urban Greece, and especially Athens, experienced a craze of spiritualism and occult séances among the upper-level class literati. Famous intellectuals of the era participated in séances and spiritual sightings, and wrote articles eponymously and anonymously on journals and newspapers to discuss the importance of such undertakings. Fueling the trend of spiritualism was also neoromanticism, which had found fiery proponents among the Greek intellectuals of the late 19th century.

The new fad of spiritualism, and the accompanying anti-materialist ideology its practices implied, forced strange alliances and conflicts between the fields of science, religion and literature. In fin-de-

siècle Greece, to be an intellectual was to be, almost by definition, active as a poet or as an author. Many of the leading intellectuals of the era were thus not only sympathetic, but protagonists of spiritual and occult séances. At the same time, many of them were active in public debates about language, literature, materialism and nationalism.

This paper attempts to trace and discuss the way that science, literature and religion interacted, as practices and as intellectual fields, in late 19th and early 20th century Greece. By identifying the discourse articulated by various actors in this brief historical episode, the papers aims to show how science, literature and religion had borders that were much more fluid that standard historiography usually suggest. Indeed, I argue that in many cases, such monolithic designations obscure rather than facilitate historical understanding. The actors themselves, as well as the public which they addressed had a much more nuanced, albeit firm understanding of their role and arguments.

19th century Greece; Science and Literature; Science and Religion; Spiritualism

Between medicine and feminism: pioneering women in Egypt and Iraq

Mònica Rius-Piniés, University of Barcelona

Saniha Amin Zaki (Baghdad, Iraq, 1920), Naziha al-Dulaimi (Baghdad, Iraq, 1923-2007) and Nawal Saadawi (Kafir Tahla, Egypt, 1931) are three different examples of pioneering women who combine the practice of medicine with a strong commitment to the cause of women's rights. Whether autobiographical or fictional, the books of Zaki (*Memoir of an Iraqi Woman Doctor*) and Saadawi (*Memoirs of a Woman Doctor*) – which bear almost the same title – are magnificent examples of their authors' identification with their societies and with feminism. The books show the difficulties their authors have had to overcome, but they are also voices that break down prejudices, stereotypes and glass ceilings.

This specific combination of medicine and feminism in the Arab and Islamic world offers a window on these societies' changing perceptions of scientific knowledge and gender over the course of the twentieth century. Moreover, Saniha Amin Zaki, Naziha al-Dulaimi and Nawal Saadawi live (or lived) in two countries, Egypt and Iraq, that underwent huge social and political transformation, first from the Ottoman Empire to the British Mandate, and afterwards, from colonialism to independence. This paper aims to analyse their careers in order to assess their achievements, the circumstances in which they lived, and the role played by medicine in their professional success. Following Foucault, we also consider the relationship between the health policies established by the state (colonial and postcolonial) and the control of the bodies of their citizens – and in particular of their women citizens. The active role of these women is also relevant in this regard in spite of the differences in the positions they have held.

women; medicine; Egypt; Iraq; Arabic

From Physics to Poetry – The Path of Life of Ernesto Sábató

Peter Maria Schuster, ECHOPHYSICS - European Centre for the History of Physics

Ernesto Sábató (1911–2011), born in Rojas near Buenos Aires, studied mathematics and physics, did his doctorate in physics 1937 at the Universidad de la Plata, received a scholarship to research at the Laboratoire Joliot-Curie at the Sorbonne in Paris, published in *Nature* during his research stay at MIT, Massachusetts USA, and became the chair of theoretical physics at the Universidad de La Plata in 1940. Yet he turns toward literature, in particular to be a novelist, in an open rebellion against the

rationality and the objective.

We accompany him along his way between “ratio and irratio”, between logic and emotion.

His mentor, the Nobel prize winner for physiology Bernardo Houssay, was extremely upset, that a physicist would opt for writing and that all his writing were a total rebellion against science. But the novel meant for Sábato the most complex intellectual activity and the most promising in trying to research the drama of our life and to describe it.

"Ernesto Sábato"; "physics and emotions"; "novels and rationality"; "communism"; "surrealism"

Reading Tikuna Indians iconographies across the boundaries between science and literature

Priscila Faulhaber, Museum of Astronomy and Related Sciences

The purpose of this communication is to analyze sky-earth relationship in terms of indigenous narratives, from the time of the explorer and anthropologist Curt Nimuendajú's ethnographic recordings. A study into the iconography of Ticuna artifacts encompasses an analysis of the significance behind the asterisms celestial movements for this people's calendar. My goal is to analyze the assemblage of asterisms depicted in a wheel by an Indian who intended to correlate the asterisms for the rainy and dry seasons. I understand that it is possible to read its iconography within the scope of the chimera principle, as defined by Anthropologist Carlo Severi. In this chimerical approach the drawings are seen as modes of non alphabetic writings and understood as valid forms of knowledge, crossing the boundaries between history of science and literature.

Tikuna Indians, iconography, chimera principle, Indigenous narratives, sky asterisms

Beckett's Calculus of the Subject: Measure and Convergence in ...but the clouds...

Treena Balds, University of California, Davis

In Plato's Ghost, Jeremy Gray identifies a “mathematical modernism” in the array of formal and methodological changes occurring in the 19th and 20th centuries. Like the humanities, mathematics then saw the bending and even breaking of formal structures once considered hypostatic to the discipline. An interbellum environment of disciplinary cross-pollination poised Samuel Beckett to inherit from both humanistic and scientific traditions. Thus T. S. Eliot's ambition that “art approach the condition of science” gains material expression in Beckett's quasi-mathematical treatment of phenomena in the teleplay ...but the clouds.... For in literature, one such structure—that of the subject—underwent its rupture during the high modernist (and subsequent poststructuralist) interrogation of its composition and integrity, and Beckett's portrayal in this play of a subject whose encounter with objects engenders its division figures also the impossibility of (re)identification that the period underwrites. In my paper, I argue that his diagrams, measurements, and rigidly prescribed actions allow the extrapolation of a distance function, which depicts the relation of the character M to his on-stage avatar M1. By mimicking a process of convergence, the latter's motion in the set amounts to a formal demonstration of the subject's relation to itself. As such, that ostensibly haphazard and contingent textual structure for which Beckett is known takes on a visage of necessity, as the play's speakers and actors inhabit the form of a fractured (i.e. modernist) mathematical proof.

Samuel Beckett; mathematical proof; convergence; subjectivity; ...but the clouds...

Goncourt's *Germinie Lacerteux* as a case study: the clinic of Love and the nosographic poetic of a hyper-aesthetic degeneration

Vanessa Schmitt, Universidade Federal do Rio Grande do Sul

France 1865. The Goncourt brothers could have conceived any kind of novel rather than a sweet love story or a chivalrous romance, both overly obvious and predictable in every sense. With a scathing irony and by apologizing to offer the public such a book, they evoked in their fourth novel prologue all the mediocrity of a readership looking for uncommitted fun and frivolity. This grim work did not correspond to the usual public expectations. Thought to be a roman vrai, the novel was intended as a case study that they defined as the clinic of Love. Hence, my objective is to analyze the concept of clinic of Love in Edmond and Jules de Goncourts' masterpiece *Germinie Lacerteux* (1865). By examining that unprecedented notion, introduced by the authors themselves in their famous preface — as properly pointed out in Auerbach's *Mimesis* — this paper aims to understand the nosographic poetic of excess and decadence that characterizes it. This outstanding artistic format created by the authors means that *Germinie* is a character strongly linked to love, whose nature varies between physiological and pathological throughout the narrative. The paroxysm of her emotional conditions results in a disaster corresponding to a hyper-aesthetic and painfully destructive incontinence.

Goncourt brothers; Naturalism; literature and science; nosographic poetic; 19th Century

002. The Ubiquity of Computing: historical and philosophical issues

Control, freedom, informatics and society: a review of informatics histories in Brazil

Alberto Jorge Silva de Lima, Centro Federal de Educação Tecnológica Celso Suckow da Fonseca

This paper aims to review the historiography of informatics, with emphasis on Brazil, from the proposition of two traditions that seem to emerge from the narratives about the sociotechnical networks in which the computer is embedded.

The first tradition can be exemplified by the work of authors such as Paul Edwards in narratives where the first American electronic computers, and technologies associated with them, are presented as supports for what the author calls the "closed world" and as metaphors, in relation to its constitution and structure, of this same world, characterized by centralized systems of command and control, of a panoptic and totalitarian character, where everything can be mapped and controlled, from macroeconomic variables to human bodies and minds.

The second tradition comprises histories where the computer appears to be associated with progressive and libertarian movements, where machines would no longer be used to construct or represent dystopian worlds, but would be key pieces in the construction of a world without centralized control, albeit ultra-connected, where information would be available to all, and cyberspace would emerge as the locus par excellence of the exercise of an ideal of humanistic citizenship.

The examples of narratives in this tradition are manifold and are generally related to the emergence and establishment of the personal computer, the Internet and the Web, and more recently, of networks and social media, such as the histories that relate computer development and the hacker culture to the counterculture of the 1960s and 1970s in the United States; the stories about the protagonism of civil society in the establishment of the first network schemes in Brazil; the stories about the reserve of informatics market in the repressive context of the Brazilian military dictatorship; the stories of the digital inclusion movements; the narratives about the contemporary experiences of Brazilian software cooperatives focused, above all, on the strengthening of social

movements; and the narratives about the institution of free software as a government policy in Brazil at the beginning of the 21st century.

Alongside the proposition of these two traditions and the resulting historiographical review, the paper also seeks to rescue the debate between control and freedom present in the literature on cybernetics to illuminate the discussions about the implications of the computer in the constitution of contemporary societies.

Control; freedom; history of computing; Brazil

Computational Metaphysics: The Virtues of Formal Computer Proofs Beyond Maths and Computer Science

Christoph Benzmueller, Freie Universität Berlin

Formal computer proofs -- irrespective of being developed interactively with modern proof assistants, fully automatically by automated theorem provers, or in a combination of both -- are still rather unpopular amongst many mathematicians. Benzmüller will challenge this stance and point to recent success stories of computer assisted proofs in maths, computer science and beyond. In particular, he will demonstrate how the rigorous assessment of rational arguments in philosophy can be fruitfully supported by modern theorem proving technology. A prominent example includes the "Ontological Argument for the Existence of God", for which even relevant new insights were recently revealed by automated theorem provers.

The latter research activities have inspired to the conception of a new, awarded lecture course on "Computational Metaphysics" at Freie Universität Berlin, which brings together students from philosophy, maths, computer science and physics.

Computational Metaphysics Formal Computer Proofs Interactive and Automated Theorem Proving Quantified Non-Classical Logics Semantical Embeddings

Error correcting techniques in Vedas

Devaraja Adiga P., IIT Bombay
Prof. K. Ramasubramanian, IIT Bombay

The four Vedas, Rigveda, Yajurveda(Shukla & Krishna), Samaveda and Atharvaveda, which are dated at least earlier to 2000 B.C.E, are transmitted through generations using oral learning techniques without any errors. The integrity of this oral tradition of learning has been preserved by the special chanting procedures known as Vikriti Paathas, which is similar to procedures used for error free transmission of messages over electronic media. There are eight type of Vikriti Paathas available for Samhita part of Rigveda, Krishna Yajurveda and Shukla Yajurveda. We will describe these Vikriti Paathas and how these error correcting techniques of chanting are helpful in preserving the integrity of Vedas.

Veda; Error correction

Peano, Universal Languages and the "Mechanization" of the Mathematical Thinking

Fábio Maia Bertato, Unicamp

Giuseppe Peano (1858 - 1932) presents his first attempt to axiomatize a branch of Mathematics in a symbolic language in his work "Arithmetices Principia Nova Methodo Exposita", published in 1889. In this work, the so-called Peano Axioms appear for the first time, allowing a more rigorous construction of the set of natural numbers. Based on the notions of "number," "one," "successor," and "equals," Peano presents the rewriting of Arithmetic in symbolic notation, as well as results concerning fractions, real numbers, and the notion of limit. It introduces notations that would become classical in a notational system more sophisticated than those presented by previous authors. Moreover, in other publications, Peano treats themes related to models, consistence and induction. Our objective is to discuss some interesting points of its approach, its mathematical and logical implications and some later developments.

Peano, Axioms, Consistency, Models

Ubiquity so that I want you!

Fernando Severo, UFRJ

A undergraduate student fatigued after taking a Calculus test faced a traffic jam on his return home. Meanwhile, at the dinner at home, a graduate student euphorically showed for the undergraduate the progress of a project they both worked on. Simultaneously, in the comfort of his office chair, a university professor who participated in the same project followed the dialogue making notes for the next class. Three distinct generations, three different places, yet the time was the same. In order to glimpse how these relationships stabilize or become fragile nowadays, we must focus on one point: the "miraculous" ubiquity of the student and his interlocutors.

Mediated by software, this ubiquity occurred during a pedagogical experiment conducted at an engineering school. Nevertheless, the ubiquity occurred was not only the result of the mediation of a software, but comes mainly from the characteristics of those individuals that the philosopher and historian of the sciences Michel Serres baptized of "little thumbs". Admired with the dexterity and speed with which youngsters thumb up their smartphones, Serres defines them as "children [who] inhabit the virtual. The cognitive sciences show that using the internet, reading or writing with the thumb.. do not activate the same neurons.. as the use of the book or the notebook. Children who manipulate various information at the same time. They do not know, they do not integrate or synthesize in the same way that we, their ancestors."

These "children" write more sliding thumbs on capacitive screens than "typing" on computers or holding pens. This has its consequences, since this ability to "manipulate multiple information at the same time" is what makes these young, the "little thumbs", capable of being or feeling the quasi omnipresence experience. It is not just the existence of electronic devices in every pocket of this hyper-connected generation that allows this sense of multiple presence. The acquired ability to know, integrate and synthesize in another way makes them inhabit and perceive another space. The students, unlike the teacher, did not have to conquer ubiquity. They are natively ubiquitous (it is not intrinsic, it is co-modification). Ubiquity is not just a technological issue, it is also a question of co-modification, of mutual configuration. From a pedagogical experiment, this article addresses the empirical and philosophical consequences of this co-modification movement that builds contemporary ubiquity.

pedagogical uses of digital technology; ubiquity; education

Historia rerum naturae gestarum and Hiperhistory

Flavia Marcacci, Lateran University

Various concepts of “history” have been conveyed throughout the history of thought. We aim to examine some of them wondering what kind of history we live today, in the era of ubiquitous computing. The great production of data is transforming our historical sense invading every life dimension, especially since the spread of the ICT has changed our daily habits and the approach to culture. Written documents made the human history, as well as big data are now making hiperhystory. In classical thought, the term *historia* generally means the collection of the outcomes of a research, namely “collection” of information; three main kinds come from the same term: *historia rerum gestarum*, referring to men and their endeavors; *historia animalium*, referring to nature and animals; *historia naturalis*, for classifying organic and inorganic substances. F. Bacon developed the approach of *historia naturalis* in order to distinguish its further three kinds: history of nature under regularity (history of created things), history of nature under exception (history of monstrous things), history of altered nature (history of artificial things). According to Bacon, the time dimension only matters to the last kind of history inasmuch able to influence the nature itself of natural things, whereas things are immutable in the other two historical approaches. A more complex concept of history might be required today, because we know as both human knowledge and natural objects can evolve and change over time. The history as *historia rerum naturae gestarum* should consider the importance of time in the description of objects, whether they are natural things or human products.

In hiperhistory, data are human products with a beginning but not an end. One of these products are also human digital identities which seem to live outside -or without - time, to the point that erasing the eternal present of digital self is very difficult, or even impossible. On line identity is an artificial thing that requires being able to manage it. Actually, for the first time in human history, people live both inside their historicity (“real” life) and their eternity (on line life). How does ubiquitous computing redefine our relation to personal history? How can we handle it?

Floridi The Fourth Revolution. Oxford 2014

Turkle The second self, Computers and Human Spirit Cambridge (Mass.)-London 2005

hiperhistory, digidentity, bacon

Computational Correctness: from type-correctness to error-handling

Giuseppe Primiero, Middlesex University

In [1] we have explored the notion of computational correctness as an evolution of the historically grounded debate between logical consequence and logical inference. Computational correctness, albeit derived from the second one, characterizes validity in entirely novel terms: execution conditions; resources accessibility; local validity and error-handling. We have illustrated this new interpretation through the proofs-as-program identity. In this paper, we ideally expand on this topic, with a philosophical analysis of computational correctness as error-handling.

We offer first a high-level overview of the historical links between logic and computing focusing in particular on the proofs-as-programs identity to highlight several trends that, apparently separately, suggested the analogy between the semantics of proofs and the structural behaviour of programs. In this light, we will argue that a conceptual shift occurred from the truth- or knowledge-preserving logical models of validity to an error-free account of computation: this is first modelled through validity as type-correctness and then is implemented in the semantics of modern computing applications as error-handling. We return to the proofs-as-programs paradigm understanding of

ICHST
2017

errors to show how it is enhanced to allow for operations that elude standard typing control.

[1] Primiero, G., Realist Consequence, Epistemic Inference, Computational Correctness. In Arnold Koslow, Arthur Buchsbaum (eds.), *The Road to Universal Logic*, vol.2, pp. 573--588, 2015.

computational correctness; errors; validity

A racing car without tires

Henrique Cukierman, UFRJ

The paper aims to bring new contributions to the history of the first computer purchased by the Brazilian Government (under the presidency of Juscelino Kubitschek), the Univac 1105, whose stated goal was to process the data from the 1960 census. However, it was not successfully used for this purpose due especially to the very slow flow of input data, related to problematic input devices. For this reason (which explains the reference to this UNIVAC 1105 as “a racing car without tires”), together with a political dispute with the new government (the presidency of Jânio Quadros began on January, 1961), this computer became the centre of a heated and long investigation, which never came to a final conclusion, regarding the accusations of bribery along the process of its purchase. Nevertheless, besides rumours that it was bought indeed for a secret mission, the development of the Brazilian atomic bomb, the paper shows its great importance for some Brazilian scientists, as well as for various technicians and engineers who had, for the first time, the opportunity to be in contact with a computer, a rarity in Brazil in the early 1960s. Finally, it is considered the possibility that its legacy of knowledge and expertise might have been relevant to the maturation of informatics in Brazil because, without that legacy, it would have been more difficult for the country, fifteen years later, through the experience of market reserve, to bet on the possibility of mastering the complex manufacturing technology of computers.

History of Informatics in Brazil, Univac 1105, The 1960 Brazilian Census

A new look at an old devil: the computer market reserve in Brazil

Ivan da Costa Marques, Universidade Federal do Rio de Janeiro

During the 1970s/80s, Brazil had a special industrial and technological policy aimed at long term goals of local technoscientific development. Officially named as the National Computer Policy (Política Nacional de Informática), it went into history known as the “market reserve policy”. Historians, sociologists and economists have taken into account the special role of a community of Brazilian computer professionals for the conception and inception of that policy. In gross terms, however, their analyses do not reach beyond the mainstream widespread simplistic claim that technically obsolete and high priced products plus the American pressure against the market reserve policy explain its “failure”. This work runs against this widespread simplistic claim by bringing in two new previously overlooked elements that provide the ground for not only going beyond the mainstream simplistic explanation but also for making that “failure” relative to preconceived notions of “success”. These crucial previously overlooked elements are:

- 1) the intervention of political police of the military dictatorship in the process. In 1980, when General Figueiredo took office as the dictator of Brazil, the SNI (Serviço Nacional de Informações) dismantled that community of computer professionals, the existence of which, but not its dismantling, was valued in previous narratives.
- 2) the appearance and spread of the microcomputer in the early 1980s, a time when half of the

Brazilian computer market was supplied by local brands with locally designed equipment. As well known, after 1980 the SNI military took command of the market reserve policy by creating a large bureaucratic agency. Somewhat surprisingly, they kept the same practices that that community of professionals they had just ousted had conceived to manage the reserved market. Those practices had been conceived for a market reserve of mini (not micro) computers. Previous narratives did not relate the fact that the community of professional was no longer there and the lack of new views to negotiate with and rather not more simply fall prey of the short term interests of business in opposition to long term goals of technoscientific development. Of course, it is not possible to claim that the firms created in market reserve policy environment would survive the microcomputer revolution (minicomputer manufacturers worldwide did not), but the melancholic “failure” of the market reserve policy has its own local explanation.

Brazil; computer markets; market reserve; industrial policy; local technology

Some philosophical considerations about the possibility of mind uploading

Lorenzo Spezia, Istituto Teologico di Assisi

According to Roy Kurzweil and other theorists of strong artificial intelligence, in the near future it will be possible to digitize the human mind, and then duplicate it uploading in a machine or in the web, indefinitely enhancing its capabilities and making it immortal. Those theories are based on two fundamental assumptions, which we try to single out, analyze and criticize from a philosophical point of view.

1.The first is that the processes of formation and operation of the human mind are completely reducible to logical-mathematical processes, the only ones compatible with the computer language. This assumption, though widely shared, does not take into account the historical genesis and hermeneutical nature of logical-mathematical systems. If instead we consider these two aspects, we realize that the entire logical-mathematical system is just a means of interpretation of reality, set to work by human intelligence included in precise temporal and geographical coordinates, so operating in a specific culture. Therefore it lacks the necessary characteristics to stand as the constitutive and operational universal principle of mind, because it is its product and not its producer. This is confirmed by the famous thought experiment of Chinese room, consistently showing that logical machines only possess the ability to manipulate language in his syntactical aspects, and not in semantical ones too: logical machines are not therefore able to really understand their environment.

2.The second is that the mind, with its peculiar characteristics, is something absolutely separated from its native physical body, that would be only an interchangeable support.

This idea makes its strong appearance, in the history of thought, thanks to Plato, for specific historical and theoretical reasons, that are inseparably bound to that particular ancient system of philosophy.

Phenomenologically thinking, it remains impossible to explain the structure of mind, its functions of consciousness and thought, apart from our body, its emotions, its characteristic processes.

We must therefore conclude that the idea of completely identifying logical-mathematical processes, mechanically performed by machines, and still partially unknown processes that, in the human mind, are at the origin of conscious thought (idea that underlies the possibility of mind uploading) it appears an operation epistemologically unfounded.

mind uploading; limits of logic; "chinese room" argument; artificial intelligence; deconstructionism

Between taxes and innovations: The Role of Federal Data Processing Service (SERPRO) in the growth of Brazilian computer Market (1964-1970)

Lucas de Almeida Pereira, Instituto Federal de Educação Tecnológica Campus Suzano

The early 1970s represented a period of remarkable expansion on the use of data processing in Brazil, especially regarding administrative aspects of companies and public and private agencies. This, attested by the exponential growth in imports of computers and peripheral equipment, which between 1969 and 1974 grew 30% per year according to the Federal Planning Secretariat (SEPLAN). This rapid growth brought impacts to the national industry, along with government action, initially with the development of a prototype computer built in the country in a project carried out by Brazilian researchers. Called "Project G 10" the prototype was developed in a partnership between two universities: USP, who designed the hardware, and PUC-RJ who coded the software. Such endeavor represented the basis for the creation of the first Brazilian minicomputer company called Computadores Brasileiros (COBRA) in July 1974.

I intend to analyze how this "takeoff" period on the computer use in Brazil occurred between 1969 and 1974, which generated the demand needed to create a high-tech industry, highlighting the action of the Federal Data Processing Service (SERPRO) in this process. The country's main Data Processing Centre in the early 1970s, SERPRO, is a public company still in activity linked to the Ministry of Finance, responsible for technological solutions related to tax control and public databases. Officially established in 1964, SERPRO would only fully operate in 1968 as a strategic body in the context of a comprehensive tax and treasury reform that occurred between 1963 and 1968, with a substantial support from the Military Regime. In addition to their tax and physical responsibilities, SERPRO was in the early 1970s a true incubator of key projects in Information Technologies needed for the Brazilian market consolidation, expanding its influence beyond the Ministry and also playing a major role in the creation of COBRA. The focus on SERPRO allows us to observe the interaction between the various key players in the creation of a computer-related field in the country and understand the dynamics of the technology market during the military regime.

History of Computers; Public administration; History of Science

Free software and solidarity economy in Brazil: licenses, practices and worldviews in debate

Luiz Arthur Silva de Faria, UFRJ

Fernando Gonçalves Severo, UFRJ

This paper narrates a recent history of mutual construction between free software and solidarity economy experiences in Brazil. A history remarkably composed of heterogeneous entities, such as computers, software and its licenses, connected to worldviews and practical aspects embedded in them. Within this history, supported by the concepts of STS field (and particularly the Actor-Network Theory (TAR), we follow the networks of four Brazilian softwares).

Solidarius is a software proposed by Euclides Mance, who started its development in 1999. The software aimed at the solidarity economy and was distributed under the Copysol regime (a variation of the free software system). The Copysol license, proposed by Mance, is open source but restricts the use of the software to the field of solidarity economy groups, as opposed to the GNU GPL License Private. Daniel Tygel met Mance at the Network of Solidarity Socioeconomy. He actively participated in the construction of Noosfero/Cirandas software, which began in 2005 and uses GPL license. Tygel tried to convince the Free Software Foundation to accept that Copysol softwares could use GPL elements (like other softwares). But, he said, to the GPL, only one value mattered to FSF: freedom, stated in general terms. Tygel reported that the actors of the FSF told that "they do not want to deal with

themes like politics, ethics etc."

In the scenario of Brazilian solidarity economy, community development banks (BCDs) occupy a prominent place. The first BCD, Palmas Bank, was founded in 1998, as a result of a community mobilization process in a favela of Fortaleza (Ceará). Since then, the Palmas bank developed and helped to replicate its methodology of social currency among the network of the 107 current BCDs. From 2013 on, this network has begun to discuss and implement social currencies through a proprietary software called E-dinheiro.

In a similar perspective, the network of the so called "Produtoras Culturais Colaborativas", with the end of a government program that created the "culture points" in Brazil, the groups that are linked to digital culture have pointed to the opportunity of providing services from local knowledge and to the exchange of this knowledge with other communities. It is in this context that the groups dealt with a specific module of creation and management of social currencies at the web platform Corais.org.

Free software, solidarity economy, actor network theory

Information Technology in Brazil and the National Information Service (SNI): exploring an ambivalent relationship (1976-1984)

Marcelo Vianna, Instituto Federal de Educação, Ciência e Tecnologia do Rio Grande do Sul

In our view, the National Information Service (SNI), a former Brazilian intelligence agency (1964-1990) was involved in two ways in the IT field. First, through direct participation: in 1979, the SNI led an intervention in order to remove the conceivers of the National Informatics Policy (PNI) and establish a new centralized agency, the Special Secretariat for Informatics (SEI). Such intervention represented a sad chapter in the history of Brazilian IT, which was characterized by an important nationalist from that time, Ivan da Costa Marques, as the elimination of the "democratic ethos of the origin of the PNI" (2012).

Our purpose is to present the other way of involvement of the SNI in the IT field. It was based on a "culture of secrecy" (ANTUNES, 2012), but as operational as the intervention process. As a "very professional source of information" (FICO, 1995), the SNI was charged with surveying and analyzing information to support both the repressive nature of the Military Regime and its attempt to institutionalize itself in the process of democratization (DREIFUSS, 2008).

The State sought to regulation of the Brazilian IT field in 1970s and 1980s ("embedded autonomy" model – EVANS, 1995), but it was unable to prevent that IT agents (scientific community, technocrats, users) clashed openly with each other because of government decisions.

An examination in the SNI's collection available in the "Revealed Memories" from the National Archive (Brazil) showed the "Service" acting as privileged observer of these struggles. "Subversive" individuals, e.g. members of the Association of EDP Professional Workers or scientific events were tracked by SNI. But some of these accusations were made by IT agents against decisions and procedures adopted by competitors or state agencies, such as CAPRE or SEI. These cases involved a large number of accusations involving corruption, smuggling of electronic components and trade disputes (e.g. Sisco Computers or DATAMEC) investigated by SNI's agents.

In short, analysis of this ambivalent involvement of the SNI on the IT field in Brazil between 1976 and 1984 may contribute to demonstrate the interest of the referred agency in mapping its potential "subversive" agents in this field. But it may also contribute to recognize the SNI as another resource used in the disputes between these agents to achieve their goals. This ambivalence may to explain the difficulty to establish an effective IT Policy in Brazil in the 1980's.

Civil-Militar Dictatorship; Social History of IT; Brazilian Intelligence Agency; IT Policy; IT Field

The Brazilian computer in the Journal "Dados e Ideias": 'in search of its soul'

Marcia Regina Barros da Silva, Universidade de São Paulo

This work evaluates the role of the journal "Dados e Ideias" as a communication vehicle of the Federal Data Processing Service, SERPRO, a Brazilian federal agency. Published during the Brazilian dictatorship, the journal addressed several themes dedicated to specific issues on Informatics. They ranged from debates on data processing issues to industrial policy issues that were of interest to government agencies, industry as well as academics. Clearly, several authors sought to influence the definition of a national computer policy. Did that also mean the search for a Brazilian computer? The dilemma about importing computer technology or developing it in Brazil was constant. It opposed the situation of technological dependence to setting up a minicomputer industry based on locally developed technology. The articles published in Dados e Ideias had a bet on a future. Here the purpose is to try to understand what was that future that the past of Brazilian Informatics planned, and to depict the traveled paths in this process. Who did bet on this? What was at stake? Initially, authors pointed out projects that sought to make feasible the association of resources available in the country and in the international market, that is, translations of international resources into local, both technical and economic conditions. An example is what became known as the "keyboard concentrator", a technology used to reconfigure the data entry activity in data processing systems to reduce the cost of equipment without losing the reliability of information. The development of the "keyboard concentrator" involved designing an interface of up to 32 keyboards connected to a single CPU and developing the software that managed the information from all keyboards into the same CPU. Compared to the solutions offered at the time by the multinationals, which implied a CPU for each keyboard, the new system represented a drastic reduction in costs, since in practice it replaced 32 expensive CPUs for 32 keyboards of much more accessible cost, using only a single operating CPU. SERPRO carried out a technological development that created a bridge between a foreign product and a local development, that is, it translated an alien technology into a Brazilian national, local habitat. The problem concerning the cost and reliability of data entry in Latin America's "largest information transcription park" was reconceptualized in order to "take into account the SERPRO's operational needs".

History; Computing; Brazil; Magazine

Complexity, ubiquitous computing and autonomy: An inquiry into the human radical enhancement project

Maria Eunice Quilici Gonzalez, UNESP – University of the State of São Paulo

Itala Maria Loffredo D'Ottaviano, University of Campinas - UNICAMP

João Antonio de Moraes, University of Campinas - UNICAMP

In this paper, we investigate possible consequences of the development of ubiquitous computing, and of the human radical enhancement project, on aspects of autonomous actions in everyday life. Autonomous action is provisionally characterized as the human ability to establish independent decisions, free of external imposed determinants, in such a way that her/his intentional conduct is (or could be) relatively self-governed. This minimalist preliminary characterization of autonomous action, in terms of self-governing activities, will be investigated from the Paradigm of Complexity, which unites interdisciplinary research in the areas of Philosophy, Physics, Biology, Complex Systems Science, and Cognitive Science, amongst others. Our hypothesis is that autonomous actions acquire a new dynamics with the inclusion of ubiquitous computing and the possibility of human radical enhancement. In this scenario, humans could re-orientate their social and biological universe as a

function of technological artifacts, especially the devices of ubiquitous computing, biochemistry, and nanotechnology. The problems that will guide the present analysis can be characterized as follows: Given the rapid development of ubiquitous computing, is there any (in)compatibility between human autonomous actions and human radically enhanced actions? What can be done with all the data collected by the Internet, smart meters, sensors, genetic engineering, and so on? We argue that the paradigm of complexity offers a useful conceptual framework for analysis of the problems in question.

Autonomous action, Organized complexity, Radical enhancement, Self-organized action Ubiquitous computing

Complexity and ubiquitous computing: A philosophical-interdisciplinary inquiry on hypotheses of transhumanist project

Renata Silva Souza, University of the State of São Paulo (UNESP)

Edna Alves de Souza, University of the State of São Paulo (UNESP)

Ana Paula Talin Bissoli, University of the State of São Paulo (UNESP)

The aim of this work is to investigate possible consequences of the development of ubiquitous computing in the context of the transhumanist project. To achieve this goal, the following question is proposed: To what extent does ubiquitous information contribute to intensify or slow down individual/environmental collaborative relationships? We witness, in everyday practices, a gradual and increasing use of ubiquitous technologies that aim at a supposed improvement of physical and cognitive capacities, with the resources of nanotechnology, artificial intelligence interface, and so on. The belief that we can replace body parts in order to improve human identity - in the collective and individual spheres - is a presupposition assumed by the proponents of the transhumanist project. According to them, we would be gradually working towards the goal of eliminating aging and indefinitely expanding intellectual, physical and psychological abilities (BOSTROM, 2003, 2005, KURZWEIL, 2005). This scenario, as transhumanists emphasize, would be consolidated with the use of resources from ubiquitous computing, also applied to an intra-corporeal human dimension. In view of these general presuppositions, favorable to the expansion and improvement of human abilities, in their biopsychosocial scope, we investigate the notion of improvement from the perspective of complex systems. According to this perspective, individual and collective improvement is linked to the collaborative relationships established between individual/environment in a long period of adjustments and common learning interactions. We investigate to what extent the human enhancement and ubiquitous computing could be in consonance with the principle of agent/environment reciprocity, according to which organisms and the environment mutually evolve. We will address this problem by employing resources available from the philosophical interdisciplinary areas of Philosophy of Mind, Complex Systems Theory (CST), and the Philosophy of Information.

Transhumanism. Complexity. Collaborative relationships. Enhancement. Principle of reciprocity

003. Doing History of Science in a Digital, Global, Networked Community: Tools and Services Linking Scholars and Scholarship

The Other Side of the Story – challenges and opportunities in building sustainable online knowledge resources

Ailie Smith, eScholarship Research Centre, The University of Melbourne

In 2010, the Encyclopedia of Australian Science (<http://www.eoas.info/>) was one of the first datasets harvested by the National Library of Australia's Trove service (<http://trove.nla.gov.au/>). This continued the activities of linking the Encyclopedia into a broader web of public knowledge resources and allowed the biographical information in the Encyclopedia, focussing on the scientific career of its entries, to be linked to resources focussing on other aspects of biographical information. With more and more resources becoming freely available online, through the digitisation of primary source material and initiatives such as the Internet Archive (<https://archive.org/index.php>) and the Hathi Trust Digital Library (<https://www.hathitrust.org/>), the possibilities for connecting previously separate pieces of information have increased and some of the untold stories in the history of science can emerge. However there can be problems in relying on an external knowledge aggregation service to connect pieces of the story. In 2016 Trove underwent funding cuts and its capacity to play this important role in the future is in doubt. In addition to this there are still holes in the scientific biographies of many notable people. There are stories that may never have been recorded in the biographical details of scientists before that are more challenging to uncover. We may need to look to other disciplines to see where the lives of prominent scientists have intersected with disciplines, such as archaeology, to fill in gaps in their biographies.

This paper will explore some of the possibilities and challenges associated with producing and sustaining online knowledge resources as well as looking at the other side of the story of several Australian scientists and how we can connect these with the existing narratives.

history of Australia science; archives; online; public knowledge resource

New proposals for organization of knowledge and their role in the development of databases for history of science

Ana Maria Alfonso-Goldfarb, Pontificia Universidade Católica de São Paulo - PUCSP
Márcia H. M. Ferraz, Pontificia Universidade Católica de São Paulo - PUCSP
Sílvia Irene Waisse, Pontificia Universidade Católica de São Paulo - PUCSP

As is known, the digital era brought new possibilities for the creation, organization and work with large databases. However, some problems make such large databases difficult to manage, as e.g., lack of a definite standard, or even a seeming impossibility to develop some standard due to the high complexity of the data. It goes without saying that these databases include the ones for the humanities and related fields, like history of science, which are characterized by countless and complex interfaces. While long established as a subject of study for the Digital Humanities, some issues relating to such databases, like their organization in a digital environment, have not yet been solved.

In this presentation we will discuss the transformation undergone by traditional models of organization and classification of knowledge, like the classic trees. In this regard, a broad scope of alternatives emerged that have long dismissed the image of a tree with a single central trunk and several poorly or not interconnected branches. Some examples are multidirectional trees, Voronoi diagrams and the manifold variants of circular trees. Within this context, we will focus on how such

decentered models contribute to new concepts on networked knowledge. In our analysis, databases in and for the history of science and its high complexity will serve as reference.

Databases for History of Science; Digital Humanities; Trees of Knowledge; Networked Knowledge; Digital Environment

History of Science: the problem of knowledge indexing and retrieval in the digital space

Carla Bromberg, CESIMA e EDMAT PUC SP

Textual-based and multimedia documents in and for History of Science are displayed in libraries and ought to be organized as to make knowledge and information on History of Science accessible. The traditional approach to organizing and providing knowledge and information was expressed by classification schemes, that were primarily influenced by philosophical traditions and then mostly based on the principle of literary warrant. Mostly dealing with textual-based documents, different types of bibliographies have been provided expressed by classification systems used in libraries, databases, including DDC, LCC, UDC and facet-analysis approach. In this context, the scholarly and scientific literature have been seen as representing facts about knowledge and structures in knowledge.

In traditional libraries, cataloguing and classification were essential in order to provide information access to users, given that they enable them to identify and locate the documents. Cataloguing elements consist of bibliographic description, subject analysis and classification. In library classification, documents are arranged, and then sub-arranged based on disciplines and sub-disciplines and relationships are provided between the documents. Currently, within a digital environment, not only textual-based documents, but documents of all sorts have to be inserted, classified and organized in order to be browsed.

In this presentation, questions regarding the classification of the documents appear so as to open a discussion: are the catalogues and the classification still the main tools to be used? Are they semantic tools? How new technologies have influenced the process of inserting documents and retrieving information? What is the relevance of the user in the digital field? How the knowledge organization system (which includes cataloguing, indexing, thesauri etc) presents biases towards philosophical position and how it mediates between the scholar -scientific community and the digital user?

History of Science and KOS; Knowledge Classification Systems; History of Disciplines and Digital World

Guidelines to formulate subject heading for history of science

Elaine Pereira de Souza, CAPES

In this presentation I will describe guidelines to formulate subject heading for history of science, with full detail of procedures and required methods. Such guidelines are needed to allow researchers retrieve relevant information. CESIMA, PUC-SP database was used as case study.

CESIMA was founded in 1994 to fill the need for a center specialized in history of science research and to promote collaborative work by providing the infrastructure required by projects. One of the first initiatives was to make documents and sources available through the creation of a Multimedia Documentation Unit.

Along the following years, the joint work of researchers, graduate students and other professionals allowed defining CESIMA core collection, which demanded a revision of the origin and historical progression of various system of bibliographical classification. While such classifications usually do not

formulate the concepts to be represented, this process was inverted in CESIMA classification approach. Subject heading represent a pre-coordinated documental language that demands rules upon establishing definite standards to achieve correct classification and indexing of topics. They involve a hierarchical relationship of alphabetically ordered terms, and elaboration should include procedures such as term collection and cross-reference identification, among others. In addition, each and every guideline should be clearly explained and normalized for validity links to be established within the subject list; its main objective is to order collections by subject.

Availability of subject heading facilitate the access to documents that deal with similar topics, since search by author, title or keywords has limitations. A controlled vocabulary solves problems such as homographs – words that share a same written form but have different meanings, polysemy – one same word has various meanings, synonyms – different words have the same meaning, etc. Thus it minimizes the ambiguity inherent to the natural language, in which a same concept might be attributed various names, and ensures the consistency of a subject heading.

subject heading; information recovery; history of science

The 'Historical Dictionary of Switzerland': a new web-based reference resource

Erwin Neuenschwander, Institute of Mathematics, University of Zurich

The Historical Dictionary of Switzerland (HDS) covers the history of mankind in the geographical area of today's Switzerland from the very beginning in Palaeolithic times up to the present. The HDS comprises four different groups of headwords: biographies (35%), articles on families and genealogy (10%), geographical entries (30%) and headwords for thematic contributions (25%). The HDS was parallelly published in each of the three Swiss national languages German, French, and Italian from 2002 to 2014. Each printed edition comprises 13 volumes, approximately 40,000 headwords and about 8,000 illustrations, what adds up to over 10,000 pages. In 1997 the HDS board decided to commemorate the founding of the Swiss Confederation of 1848 by an internet publication of the HDS for the anniversary year 1998, which is now being augmented by multimedia and linked data to a web-based reference resource (cf. www.hls-dhs-dss.ch).

Our contribution will first briefly describe the complex editorial processes which were necessary to develop the whole subject area of mathematics and natural sciences in the print HDS – covering about 1,200 biographies and approximately 40 thematic articles – supervised by the presenter in the years 1994-2016. We will then discuss the transformation of the database – set up for the print HDS – into a genuine multimedia site incorporating all kinds of historical audio-visual documentation – including the pictures and infographics of the print version. Finally, we will present and analyse further plans to build a true networked Swiss humanities information system on a large scale through the Web service metagrid, which makes it possible to set up, administrate and analyse links between identical entities (e.g. persons, organisations, or geographic terms) from different websites and databases. This networked information system should integrate in the near future the electronic resources from library and archival catalogues (Swissbib, Helveticat, HelveticArchives, etc.), and from further reliable historical online databases (BSH, Dodis, Elites suisses aux XXe siècle, Foreign Relations of the United States, LONSEA, etc.). It should allow queries of big data volumes, including geo- and chrono-referenced, medium-specific and subject-based queries, and also combinations of these.

Digital humanities; Swiss reference resources; Swiss historical information network; Bibliography and documentation

The Correspondence of Ferdinand von Mueller: From nineteenth century paper to twenty first century data

Gavan John McCarthy, University of Melbourne

This paper will outline the issues and challenges of creating a data corpus of nineteenth century records in a digitally preservable and computationally enabled form. In the 1980s, Professors Rod Home and Arthur Lucas, in conjunction with a small team of collaborators commenced a project to locate, transcribe and eventually publish an edition of correspondence of the Victorian botanist Ferdinand von Mueller. The original Mueller 'archive' was destroyed through administrative misadventure in the decades after his death in 1896, aged 71. Mueller was a prolific correspondent and trader in plant specimens, seeds, zoological materials and human remains. One of the aims of the project was to produce a scholarly edition of the correspondence and similar materials to enable other researchers access to resources that have hitherto unavailable for study. Of the more than 100,000 items believed to have been created by Mueller, the team has located over 15,000 items which have all been 'marked-up' to meet the scholarly annotation and editorial protocols established at the outset of the project. Since the 1980s the computer tools available to the team have changed dramatically. So, what was originally conceived as a 'print' scholarly edition has been re-invented as a 'digital' edition that will be available over the web. The representation of scholarly knowledge as human readable and comprehensible information was the goal of the print edition to which has been added its representation as computer analyzable data. To enable this transformation additional tools and expertise were required thus bringing in Associate Professor Gavan McCarthy and Conal Tuohy. A pipeline transformation tool was built to turn the styled MS Word documents into standardized Text Encoding Initiative (TEI) XML documents and on open source system (XTF) from the California Digital Library was utilized for analysis and access. As will be shown the transformation was dramatic, radically changed the work of the original team of scholars and opened up the project for the next generation of digitally-oriented Mueller enthusiasts.

Computational HPS; Digital Preservation; History of Botany; History of Australian Science; Global Networks

On the Implication of Centralized Data on Social Media Platforms for Humanities Research

HUANG Lei, School of Humanities at University of Chinese Academy of Sciences

With the rapid growth of the World Wide Web, social networking sites and blogs have become one of the major research tools and objects for humanities research since Web 1.0. However, social media data centralization is emerging. Under this certain situation, the rise of data usage characteristics is causing humanities research to shift toward data-centralization. Furthermore, big data has been proven to be a lens for historical research. More data has been concentrated by the fusion of information and communication technologies (ICTs). The knowledge spillover effect of data centralization in humanities research will be more noticeable in the short-term future. Two topics will be discussed in this paper: (1) the primary technology system of humanities research data on social media; and (2) the implication of centralized humanities research data on social science. Data centralization was based on related ICTs technologies system since Web 1.0. A timeline table, which ranges from Web 1.0 to Web 2.0, will be drawn to figure out the critical ICTs for the centralization of data on social media platforms. Data centralization is creating risks of data monopoly, which will damage the future of independent research. Finally, decentralized data usage will be required for humanities studies in the next level of data application.

Centralized Data, Social Media, Humanities Research, Research Data Usage

Cybernetics and Artificial Intelligence in the 21st century: From the Golem's Jewish Myth to IBM's responsive Watson

Jose Luiz Goldfarb, PUC SP
Odecio Souza, PUC SP

It can be right to consider that nowadays the Digital Humanities (DsHs) looks forward for a high cinergy between scholars from the Humanities and from the Computer fields. That search is justified in providing a high degree of efficacy of electronic tools that should improve humanities activities and be increasingly tailored for their needs. We consider that an important mechanism, known as Data Mining is used into DsHs to assist researchers in their relationships with the universe of the Internet - World Wide Web - and with large databases stored in dedicated machines.

At CESIMA (PUC-SP) we have invested in that mechanisms, building a large database containing documents from the area of History of Science and especially in a tool to improve the indexing of that documents. We will present here the first results of these studies that seem to indicate the convenience of the application of Data Mining for organization and indexing in digital libraries opening new perspectives for the researches of the field.

Once Data Mining uses concepts from areas as Cybernetic and Artificial Intelligence, we want to rescue the traditional fears awakened over the centuries when we imagined the creation of automata that should help the human but that end up turning against its creator. The Jewish myth of the Golem, or the more famous Frankstein, are older examples that we will analyze, until arriving at the most current debate with the HAL in the 2001 a space odyssey film and book. It will also be our object of reflection to assess how much the most recent developments, in the 21st century, are the creation of less of an individual cybernetic being, and more the emergence of social networks, which many refer to as a collective intelligence. That collective intelligence could involve, for instance, the use of the responsive capabilities of the IBM's Watson.

digital humanities; data mining; artificial intelligence; cybernetics

Digitising Charles Babbage at the Science Museum, London: managing expectations, enabling access

Nicholas Wyatt, Science Museum

The Science Museum Group's mission is to "engage people in a dialogue about the history, present and future of human ingenuity" and it is achieving this increasingly through digital means. A new collections web portal is providing enhanced access to high-quality information and images for its collections. Focussing on the digitised Charles Babbage Archive, this paper describes how such access can fulfil expectations of scholars world-wide, while catering for other audiences.

Much has been written on linking metadata for archives, objects and printed material, often focussing on the technical aspects. The walls between different data silos are breaking down and the adoption of new metadata standards and tools should make the task easier. There are many challenges to overcome, but the creation of enriched content is gathering pace. In the past the Science Museum created a number of websites with distinct identities that sought to link collections together, often adding interpretive content for different user groups. These are now outdated, many of their features are inaccessible and they present an incoherent picture of the Group.

The Museum now has a renewed emphasis on research and digital access and the launch of its Collections Online portal in December 2016 should fulfill some expectations, but the demand for more digitised content will continue. The Babbage Archive was digitised in 2011 and has been

exploited in different ways, most recently via Collections Online, much to the delight of scholars world-wide. But how can this enhanced access be exploited and presented in a meaningful way for the historian, researcher or a member of the public? Why is web design so important? Audiences have different needs so we must tailor our services. The Museum's new library in London, the Dana Research Centre and Library, celebrates promotes access to information about all the museum's collections, no matter which system is used to document it. This paper will examine the challenges we face in the Science Museum and the role that librarians, archivists and digital professionals have in making digital access possible.

Digitisation; Research; Access; Archives; Libraries

Shaping Historical Knowledge for a Digital Infrastructure: The IsisCB and the History of Science

Stephen Weldon, University of Oklahoma, History of Science Department

The IsisCB Explore went online in 2015 as a foundational digital resource for historians of science. Built on the History of Science Society's 100-year-old Isis Bibliography of the History of Science, this service is meant to lay the groundwork for a digital infrastructure to support historical work in the relatively new digital environment where so much modern scholarship now takes place. In order to create this resource, the director of the project, Stephen Weldon, has learned how to shape traditional historical methods, practices, and resources to fit the new digital paradigm. Computer and networking technologies have been built out of the needs and practices of technologists, natural scientists, and business innovators, all of whom employ it in very specific ways, quite different from the practices of humanistic scholarship, and history in particular. As a result, the digital environment is not especially friendly to historical work or products. As a result, it has taken a great deal of effort to understand and refactor historical data so that it functions well within a digital knowledge ecology, a "knowledge infrastructure," as Christine Borgman refers to it. This paper describes the difficulties (epistemological, cultural, and economic) that make the creation of tools like the IsisCB Explore service challenging for historians and suggests some ways forward.

Digital history; Bibliography; History of science as a discipline; Historical practice; Digital knowledge infrastructure

Thirteen ways of looking at institutional history: A model for interconnected digital exhibits from science archives

Venkat Srinivasan, National Centre for Biological Sciences

TB Dinesh, Servalots

Bhanu Prakash, Servalots

T Pradyumna, Servalots

A Shalini, Servalots

Over the past decade, there have been many efforts to streamline the accessibility of archival material on the web. This includes easy display of oral history interviews and archival records, and making their content more amenable to searches. Science archives wrestle with new challenges, of not just putting out the data, but of building spaces where historians, journalists, the scientific community and the general public can see stories emerging from the linking of seemingly disparate records. We offer a design architecture for an online public history exhibit that takes material from existing

archives. Such a digital exhibit allows us to explore the middle space between raw archival data and a finished piece of work (like a book or documentary).

The National Centre for Biological Sciences (NCBS) digital exhibit is built around thirteen ways to reflect upon and assemble the history of the institution, which is based in Bangalore, India. (A nod to Wallace Stevens' poem, *Thirteen Ways of Looking at a Blackbird*).

The exhibit tries to bring to light multiple interpretations of NCBS, weaved by the voices of over 70 story tellers. The material for the exhibit is curated from records collected to build the Centre's archive. The oral history excerpts, along with over 600 photographs, official records, letters, and the occasional lab note, give a glimpse into the Centre's multifaceted history and show connections with the present. The exhibit builds upon already established software tools. It is the first phase of a digital experiment in archiving, journalism and story telling. In the next phase (due November 2017), we hope to release a standard architecture and template that can work for a variety of institutions/places and allow multiple interpretations of archival material. This will be an open source, publicly available package. The template will allow visitors to write their own narratives around archival material – that is, shape their own exhibits. Following that, in the third phase (tentatively spring 2018), we hope to tie together the histories and start forming networks of stories linked to each other across institutions, places, events, people and time. The aim is to show meaningful connections between the material across different archives, where each new search criteria presents a different network of stories associated with the search.

storytelling; digital; archive; exhibit

Science Networking: Role of Online Encyclopaedias

Natasa Jermen, Miroslav Krleza Institute of Lexicography
Zdenko Jecic, The Miroslav Krleža Institute of Lexicography

Encyclopaedias and other reference works have always been an important tool for the dissemination of scientifically verified and consolidated information and as such they have formed an important part of the didactic infrastructure. Their role is even more underlined with the emergence of online open access encyclopaedias, as they enable a systemic orientation within the ever-increasing amount of data and information, thus becoming means to deal with information overload. This paper will discuss the role of online encyclopaedias as a specific component of the scientific infrastructure. The hypothesis is that online encyclopaedias, thanks to their role in synthesis, networking and generation of knowledge, could be applied to the history of science research, to which multilayered, interdisciplinary approach is obligatory. An epistemic and historiographic evaluation of this new methodological approach will be given, with special emphasis on innovations introduced by digital technologies. Due to the knowledge organisation and comprehensiveness, the encyclopaedia itself acts as a semantic network, which by connecting already known facts together enables new insights. Thanks to the properties of the digital media, online encyclopaedias could achieve even higher levels of internal and external knowledge networking by linking to the digital data from various sources (eg. libraries, museums, archives, social networks). Several encyclopaedias that are concerned with the history of science will be analysed, with the special emphasis on the recently initiated open access Croatian encyclopaedia of technology. It will serve as a platform for knowledge networking and sharing, thus enabling the exchange of information on the development of technology at international level, as well as the positioning of Croatian technology in the global context.

reference work; online encyclopaedia; scientific infrastructure; Croatian encyclopaedia of technology

004. Local, regional, and transregional perspectives on ancient and medieval astronomy

Determination of the ascendant in the Kerala school of Indian astronomy

Aditya Kolachana, IIT Bombay

The determination of the ascendant (lagna in Sanskrit)---which is the point of the ecliptic on the eastern horizon---has been an important astronomical problem in India, where it was culturally important to determine the rising sign for occasions like the birth of a child, or to conduct auspicious events like weddings etc. Accordingly, lagna calculations have been dealt with prominently in most major Indian astronomical works, and over time astronomers have dedicated works exclusively to this problem. One such astronomer is the illustrious Mādhava of Saṅgamagrāma (c. 14th century)---the founder of the Kerala school of mathematics and astronomy---who in his work *Lagnaprakaraṇam* discusses different methods for determining the lagna. Whereas earlier works relied on certain approximations, Mādhava and the scholars of the Kerala school improved the accuracy of lagna calculations through the use of a variety of theoretical tools like *kālalagna* etc. In our paper, we shall highlight some of the important methods of lagna calculation presented by Mādhava in this previously unpublished work, and discuss his contribution to this area.

Ascendant; Lagna; Madhava; Lagnaprakaranam

Astronomical resources for elaborate Greek horoscopes

Alexander Jones, Institute for the Study of the Ancient World, New York University

Of the more than 150 currently known Greek horoscopes preserved in papyri from Greco-Roman Egypt, the great majority are of a "minimal" type, recording just the individual's name, birthdate and birthtime, and the zodiacal signs occupied by the Sun, Moon, planets and ascendant as a simple list. The remainder provide either greater precision (typically longitudes of heavenly bodies and astrologically significant points in degrees) or additional astronomical and astrological data. A category of "elaborate" or "deluxe" horoscopes may be loosely defined as horoscopes in which positional data are specified with numerical precision and in which the range of data is significantly broader than in minimal horoscopes, often resulting in a document extending over multiple columns of text on a papyrus roll. In Neugebauer and van Hoesen's 1959 *Greek Horoscopes*, horoscopes for individuals born in AD 81 (P.Lond 1.130), 95 (P.Lond 1.98), and 137 (P.Paris 19 and 19bis and P.Lond 1.110) represent the elaborate type. At present between 20 and 30 elaborate horoscopes---some of them very fragmentary---can be identified, ranging in date from the mid first century through the mid fifth century of our era.

Whereas for a minimal horoscope an ancient astrologer required little mathematical skill and few astronomical resources, the composition of an elaborate horoscope involved more advanced technical challenges including the direct employment of numerical tables for calculating planetary positions and functions of spherical astronomy. The present paper explores the extent to which it is possible to learn the character and quality of these tables from the preserved data.

astronomy, astrology, Greek

The role played by concepts in Ptolemy's proof of the central position of the Earth

Aníbal Szapiro, Universidad de Buenos Aires

In his *Almagest* [I, 5; Hei 1, 17], Ptolemy provides an astronomical proof that the Earth is at the center of the heavenly sphere. As is commonly pointed out, it is an indirect proof because any other possible position has consequences that are not compatible with astronomical observations. And, as it is generally underlined, it proves only that the Earth is relatively at the center of the heavens (what Copernicus uses in his *De Revolutionibus* [I, VI] to propose that it is not the Earth but the Sun that is at the center, while the Earth is relatively close). In this talk, I state that the success of Ptolemy's proof depends on many assumptions that are not usually pointed out. Given the Ptolemaic meaning of some astronomical concepts used in the proof (as horizon, equator, pole, ecliptic or sphere), the experience shows that the Earth must be at the center of the heavenly sphere (or near it). But, given other meanings (as those after Galileo), experience does not prove anything about the position of the Earth in the Universe. So the meaning of concepts played a decisive role in the acceptance of the central position of the Earth.

Ptolemy; Astronomical Concepts; Horizon; Earth

The computational challenges in reconstructing the astronomical tables of Amṛtalahaṛī of Nityānanda

Anuj Misra, TAMAS, PSL-Observatoire de Paris

The Amṛtalahaṛī (or perhaps, the Kheṭakṛti) of Nityānanda is an undated Sanskrit manuscript found in the collection of the University of Tokyo discovered by Prof. Pingree. This manuscript contains numerical tables for computing calendrical elements (like tithis, nakṣatras, yogas) along with other astronomical tables like the right and oblique ascensions tables of the zodiacal signs, the planetary equation tables and mean motion tables. It also includes a combined Sine table, solar declination table, lunar latitude table, and various gnomonic shadow-length table for arguments extending from one to ninety degrees or arc.

This work, along with the *Siddhāntasindhu* (a Sanskrit translation of the *Zīj-i Shāh Jahānī*, c. 1630s) and the *Sarvasiddhāntarāja* (a siddhāntic text, 1639) represents the three works known to have been authored by Nityānanda. We attempt to mathematically analyse a selection of the tables of the Amṛtalahaṛī in an effort to understand the challenges in reconstructing numerical tables from seventeenth century Mughal India.

Sanskrit, Astronomical tables, Nityananda

Martianus Capella's calculation of the size of the Moon

Christián C. Carman, Universidad Nacional de Quilmes / CONICET

The eighth book of Martianus Capella's famous *De Nuptiis Philologiae et Mercurii* deserves a prominent place in the history of astronomy because it is the oldest source that came down to us unambiguously postulating the heliocentrism of the inner planets, i.e. Mercury and Venus. Just after the paragraph in which he asserts that Mercury and Venus revolve around the Sun, Capella describes a method for calculating the size of the Moon, as well as the proportion between the size of its orbit and the size of the Earth. It is possible to find some descriptions of the argument in general histories

of astronomy or in books dedicated to Capella's work, but usually they do not try to make sense of the argument. Rather, they limit themselves to describe or paraphrase what Capella says. As far as I know, there is no single monographic study of the argument. The explanation for this absence is simple: the calculation offers many difficulties in its interpretation, for it shows obvious inconsistencies in the steps of the argument and apparent arbitrariness in the selection of the data used. In this talk, I offer an interpretation that tries to discover, behind Capella's confusing presentation, a well-sound argument for calculating the Moon's absolute size. Interestingly, we have no records of this argument in other sources, at least in the form described by Capella.

Lunar size; martianus capella; solar eclipses

Studies in Arabic Astronomy in the Early Crusader States

Dirk Grupe

A partly preserved set of Latin astronomical texts from mid-twelfth-century Syria originally included a collection of astronomical tables, a commented Latin translation of Ibn al-Haytham's cosmography *On the Configuration of the World*, and an Arabic-Latin translation of the *Almagest*. The texts were produced for a Western European readership that was still unacquainted with Ptolemaic astronomy. At least one of the translators, Stephen of Antioch, was an Italian who must have received a profound training in Arabic astronomy during his stay in the crusader Levant. The Latin translations from Syria give an example of the Arabic texts that were available, and how these texts were used for studying astronomy, in a particular milieu in the east. The translations also reveal details of the astronomical and cosmological debate among oriental astronomers during the twelfth century, of which the Arabic sources have left us only poor evidence.

Arabic-Latin; Almagest; astronomical tables; Ibn al-Haytham; crusader states

Scientific instruments in al-Battani's *Zij* and in Plato of Tivoli's Latin translation. A comparative study of scientific terminology in Arabic and Latin associated to the construction of instruments

Emilia Calvo, University of Barcelona

Rosa Comes, University of Barcelona

Al-Battani was one of the most influential astronomers of the first Islamic period. He was born in Harran (Turkey) before 858 and died near Samarra (Iraq) in 929. His biographers described him as a famous observer and a leader in geometry, theoretical and practical astronomy, and astrology. His *al-Zij al-Sabi* is a very influential work on astronomy, influenced by Ptolemy's *Almagest*. Only one Latin translation of his *Zij* is extant. It was carried out by Plato of Tivoli a 12th C. translator working in Barcelona, in the Ebro valley region. Among the many treatises he translated, dealing with astronomy, astrology, alchemy and mathematics, this translation was the most important one, exerting a great deal of influence on the work of later European astronomers such as Regiomontanus, who profusely annotated the copy nowadays preserved in the ms. Cent.VI.21 at the Nuremberg Stadtbibliothek, and Copernicus, who cites the Arabic astronomer as "Albategnius" as much as 23 times in his *De Revolutionibus*.

The aim of our paper is to present a comparative study of the scientific concepts and terminology, in Arabic and Latin, particularly the terms corresponding to the last two chapters, (namely chapters

56th and 57th) of al-Battani's Zij, dealing with the construction and use of several scientific instruments such as the sundial, the armillary sphere, the triquetrum and the horary quadrant.

Latin translation; astronomical instruments; Battani; Plato of Tivoli

Jamshīd al-Kāshī's Tables of Planetary Latitudes

Glen Van Brummelen, Quest University

Jamshīd al-Kāshī, one of the greatest human calculators of all time, composed his masterpiece of computational astronomy — the Khāqānī Zij — in early 15th-century Iran. Within its pages we find a set of double-argument tables for determining the latitudes of the planets. The tables for the superior planets contain no entries; the table for Mercury is full; and the table for Venus is incomplete. Elsewhere in the Zij we find a startling original method of finding latitudes, but we demonstrate that his tables do not make use of it. We provide the results of statistical and historical analyses to make what conclusions we can about how al-Kāshī composed these tables, partly as a case study for the power and limitations of the use of computational methods to make inferences about historical tables.

astronomy; medieval; tables

A point with many faces: the diverse functions of the equant point in Ptolemy's Almagest

Gonzalo Luis Recio, UNQ-UNTREF-CONICET

The understanding of irregular planetary motions constituted one of the most difficult and important problems in Ancient Greek astronomy. One of the most famous and revolutionary steps in the search for solution to that problem was the introduction of the equant point, that is, the idea that some elements in the planetary models had a center of uniform angular velocity which was different from their geometrical centers of movement. That step was taken by Claudios Ptolemaios. In my paper I will discuss the different functions of the equant point in two models from Ptolemy's Almagest. The core part of the discussion will be the evaluation of the models for Venus and Mars. I will describe the parameters to which Ptolemy arrived when building his models for those planets, and show in what ways the equant point solved different problems in each case. Furthermore, I will also show how this way of understanding the roles of the equant point sheds light on other aspects of Ptolemaic astronomy.

Ptolemy; Almagest; equant point

Editing and analysing the Tabule magne of John of Lignères (Paris c. 1325)

Husson Matthieu, CNRS-Observatoire de Paris

John of Lignères is, with John of Murs, John Vimond and John of Saxony, among the most important astronomers of the Parisian milieu which formed the Parisian Alfonsine Tables between 1317 and 1327. These tables formed the core of the Alfonsine tables which in various formats were the main

computational tool of astronomy in Europe well into the 16th century.

Among his various astronomical works ranging from the design of planetary instrument to the redaction of a *Theorica planetarum*, the *Tabule magne* are a striking example of John of Lignères ability to explore new layout and were particularly important in the reception of the Alfonsine tables in England. The tables and canons are known to be, extent or in part, in seven manuscripts which testify the reception of the work in different milieus and present multiple variations, in the order and content of the canons, in the selection and format of tables or in the type of numbers used. The wealth and depth of these variations concentrated in a relatively small number of manuscripts for a work of a significant historical importance make the *Tabule magne* a particularly interesting case study in the perspective of exploring how a database combining edition and mathematical analysis tools may open new perspectives in the inquiry of ancient astronomical tables.

Astronomical tables; Mathematical practices; Edition

Published and unpublished Arabic astronomical ephemerides: Long term tradition, scientific change and local adaptation

Johannes Thomann, University of Zurich

Ephemerides are an important type of source for the study of regional practice in Astronomy. Early Arabic fragments of ephemerides were found in Egypt and the place for which they were calculated can be determined. Generally, the meridian was not adapted to the local region, but was taken over from the astronomical tables which were used. An ephemeris for the year 931/932 C.E. was calculated for the city of Aswan in Upper Egypt, while the astronomical tables used for calculation were based on the meridian of Marw in Central Asia. At first new achievements in astronomy reached Egypt with much delay, but scientific progress is documented in ephemerides for the years 954/955 C.E., 994/995 C.E., 1002/1003 C.E., and 1026/1027 C.E. Besides ephemerides, astronomical almanacs of an entirely different form existed, which included lunar aspects with the planets and their astrological interpretation. Some visual elements and the use of the lunar mansions point to an eastern origin, possibly in Sassanian Iran. From these two types, a combined type was created with a double-page layout in which the astronomical ephemeris part was placed on the right page and the almanac part on the left page. The earliest example is an ephemeris for the year 1044/1045 C.E. The lunar aspects with the planets and their time of event were expressed in words. However, the only early document from outside Egypt, an ephemeris made in Samarra for the year 1182/1183 C.E. shows a different form of presentation. In the parts of the lunar and planetary aspects the names of the planets and the aspects are written as one-letter symbols. Later the same system of abbreviations appears in an Arabic document from the Cairo Geniza, an almanac for the year 1233/1234 C.E. The double page layout continued to be the standard form of ephemerides in the Islamic World until the end of the 19th century. In the West the same form was used both in Greek and Latin ephemerides. A Greek ephemeris for the year 1336 produced in Trebizond has an analogue double-page layout, mirror-reversed according to the left-to-right writing direction. The same is found in the Latin ephemeris of 1293 C.E. by William of Saint-Cloud. The two page layout was later chosen by Regiomontanus and Stöffler. Kepler's "Ephemerides", printed in 1617 C.E. in Prague, were a product of the most advanced astronomical theory of the time, but appeared in the same dress designed more than half a millennium before in far away Samarra.

Ephemerides; Arabic; Astronomy

ICHST
2017

Babylonian Astronomy Outside of Babylon: The Case of Nippur

John Steele, Brown University

The history of Babylonian astronomy is often written as if there it were a single entity. However, recent work by myself and others has shown that there existed subtle differences between astronomical practice at the cities of Uruk and Babylon. In this presentation I will undertake a close examination of the small number of known astronomical and astrological texts preserved from the city of Uruk and compare them with with astronomical texts known from Babylon to address the question of whether there were also differences in astronomical practices between these two cities.

astronomy; Babylon; Nippur; cuneiform

Evolution of computational texts in Sanskrit astronomy: The Rajamrganka of Bhojaraja

Kim Plofker, Union College

To the renowned 11th-century Paramara ruler Bhojaraja is ascribed a seminal astronomical handbook, the Rajamrganka. We will investigate distinctive computational methods exhibited in some of its algorithms and associated tables, and trace their development in some earlier and later works. In particular, recent research has explored some algebraic approximations to trigonometric functions in the astronomical handbook of Bhaskara II. This paper will discuss the antecedents of Bhaskara's innovations in Bhojaraja's work.

Sanskrit astronomy; Bhojaraja; Rajamrganka; approximation techniques

Computer-aided analysis of sunrise and sunset tables in Yuan and Ming China (A.D. 1271-1644)

Liang Li, Institute for the History of Natural Sciences, Chinese Academy of Sciences

This presentation will introduce two types of sunrise and sunset time tables in the Chinese calendrical systems during the Yuan and Ming period (A.D. 1271-1644). The first type was used for calendrical calculation by experts, while the other one mainly for laymen. With the help of computer-aided analysis and case studies, two methods which were used to calculate these tables are explained. The analysis shows that the first method named "arc and sagitta method" is accurate and more coincident with the theory, but too complicated and could bring heavy calculation burdens. The second method named "nine domains method" is simple and easy, but not accurate enough. The official astronomers in the Yuan and Ming dynasty followed the first method to calculate the sunrise and sunset tables which used for the capital Beijing and Nanjing respectively. Moreover, how these tables were transmitted to the Kingdom of Joseon and how they were modified and used in Korea by Korean astronomers will also be discussed.

sunrise and sunset tables; computer-aided analysis; Chinese calendrical systems; Korean astronomy

ICHST
2017

Relations between Eastern Arabic Commentaries on the Almagest

María José Parra Pérez, Independent Researcher

An extensive examination of the existing manuscripts of Arabic commentaries on the Almagest has revealed hitherto unknown relations and variations among a larger number of preserved texts. Findings include previously unknown commentaries as well as variations in the reception and transmission of well-known authors.

In the present talk, some of the new findings will be presented, concentrating on commentaries from the area of present-day Iran during the period between the 13th and the 17th centuries A.D.

Selected examples will be discussed in chronological order, based on representative passages related to Ptolemy's cosmological outlines in Book 1 of the Almagest.

Commentaries; Almagest; Iran;

Between the local and the global. The qibla scheme in the Kitab al-Tabsira by al-Ashraf Umar

Petra G. Schmidl, Goethe University, Frankfurt

In 13th c. Yemen, the Rasulid sultan al-Ashraf Umar (d. 1296) wrote his Kitab al-Tabsira fi ilm al-nujum ("Enlightenment of the science of the stars"), a treatise that deals in fifty more or less independent chapters with astronomy, astrology, mathematics, geography, divination, magic and other related topics. In chapter xxxvii the author presents two schemes, one that relates lunar mansions, cardinal directions, seasons, and zodiacal signs, and another for determining the direction to Mecca, the qibla. In such a scheme cities and regions are arranged around the Kaaba, directions described by astronomical horizon phenomena.

This talk will consider the qibla schema in al-Ashraf Umar's Kitab al-Tabsira and examine what it tells about the author's knowledge of the Yemeni sources and of the world around the Kaaba. With this in mind, the first part of the talk will introduce briefly the sultan's life and scientific oeuvre. Further, it will include some background information concerning al-Ashraf Umar's Kitab al-Tabsira. After that, the second part will compare his qibla scheme with others of Yemeni origin. In particular, it will concentrate on those preserved in the Tuhfa [...] fi tasyir al nayyirayn wa harakat al kawakib ("Book [...] on the revolutions of the two luminaries and the motions of the planets") by Muhammad b. Abi Bakr al-Farisi (Yemen, d. 1278/79), who was related with the Rasulid court during the reign of al-Ashraf Umar's father, al-Muzaffar Yusuf (d. 1295). Although all such qibla schemes use a limited terminology and are arranged in a similar way, this comparison will allow to distinguish whether al-Ashraf Umar's knowledge of the local and the global is based rather on booklore or rather on experience.

astronomy; Yemen; geography; Islam; 13th century

Computation of Sines by Nityananda in his Sarvasiddhantaraja

Ramasubramanian Krishnamurthi, Indian Institute of Technology Bombay

K. Ramasubramanian, Indian Institute of Technology Bombay

The Sarvasiddhantaraja (1639 CE) of Nityananda is a monumental treatise that provides a comprehensive treatment of various aspects of astronomy. Since trigonometry, in particular computation of accurate values of sines was vital for professional astronomers, Nityananda gives a

systematic and detailed account of this topic in over sixty-five verses in one of the early chapters in this treatise. As is the case with much of the *Sarvasiddhantaraja*, Nityananda introduces certain novel features which are not found in prior treatments, of this topic in the Indian tradition. Some of these features are his own insights, whereas others seem to have been inspired by Arabic sources. During the talk, we will try to highlight some of these special aspects, as well as other significant features of this interesting work by Nityananda.

Nityananda; Sine computation; Siddhanta

Cracking the *Tabulae permanentes* of John of Murs, Paris, c. 1321

Richard Kremer, Dartmouth College

In their classic study of “Five centuries of finding true syzygy,” J. Chabás and B.R. Goldstein identified as the earliest tabular solution to this difficult computational problem a double-entry table prepared in the twelfth century by Ibn al-Kammad. But al-Kammad’s table requires users, before entering the table, to first compute the solar and lunar corrections as well as the solar and lunar velocities at the time of mean syzygy. In the early 1320s, John of Murs, possibly assisted by Firmin of Beauval, constructed a more “user friendly” (Chabás and Goldstein) double-entry table that requires knowing only the solar and lunar anomalies at the time of mean syzygy. Versions of this table were incorporated (without attribution) into the subsequent eclipse tables of Immanuel ben Jacob Bonfils (1350s), John of Gmunden (1420s), and Georg Peurbach (1450s); the latter were printed in 1514 and widely used throughout the sixteenth century. In 2001, B. Porres and J. Chabás published an edition, with English translation, of the canons to the *Tabulae permanentes* but they did not ask how the tables were computed. In this paper, I shall offer a proposal for that algorithm and will discuss the “table-cracking” procedures I employed to find that algorithm.

syzygy, John of Murs, Ibn al-Kammad, Immanuel ben Jacob Bonfils, John of Gmunden

The use of Algebra (*bijaganita*) to solve Diurnal Problems by the Indian Astronomer Bhaskaracarya II (12th Century CE)

Sita Sundar Ram, The Kuppuswami Sastri Research Institute

Bhaskaracarya II was a great astronomer-mathematician who flourished in the 12th century CE. His magnum opus was the *Siddhantasiromani* which can be divided into 4 sections –The *Lilavati* on arithmetic, the *Bijaganita* on algebra, the *Grahaganita* and *Goladhyaya* on astronomy.

In the *Grahaganita*, Bhaskara deals with the mean and true longitudes of planets, the gnomonic shadow, the lunar and solar eclipses, the elevation of the lunar horns, the chapter on time, place and direction and other allied topics.

The chapter *Triprasnadhikara* dealing with the three problems of time, place and direction has always received great attention and Bhaskara has many interesting problems regarding them. Bhaskara resorts to algebra which he has already dealt with in *Bijaganita*, to solve some of them.

Consider the problem of finding the gnomonic shadow (essentially $R \cos z$ where R is a constant and z is the zenith distance of the sun), corresponding to arbitrary rules of the azimuth and the declination.

Bhaskara mentions that this problem had been solved for particular cases of the azimuth, A (like $A = 1800, 1350$ and 900) by the previous astronomers. He goes on to present the solution for a general azimuth in verses 49, 50 and 51. This involves the solution of a quadratic equation, and he provides the explanation with all the details in the *upapatti* (proof or demonstration) for the verses. He also

discusses the cases when the equation has two physical solutions. Bhaskara uses algebra in other instances also. This paper will discuss some of the diurnal problems given in Grahaganita.

Bhaskaracarya II; algebra; astronomy; Middle Age

Astronomical Proof of the One God in (ps.) Māshā'allāh's Liber de orbe

Taro Mimura, Hiroshima University

The Latin Liber de orbe ascribed to Māshā'allāh (d. c. 815), a court astrologer in the Abbasid dynasty, gained great popularity as an introductory textbook on cosmology in Europe since the twelfth century. Until recently, no one had been able to locate it in Arabic works, but fortunately, I identified two Arabic manuscripts (in Berlin and Philadelphia) containing its Arabic original. Furthermore, by analyzing the contents of the Arabic Liber de orbe, I denied its attribution to Māshā'allāh, and identified its title and author as Book on the Configuration (hay'a) of the Orbs by Dūnash ibn Tamīm (fl. 950), a Jewish physician and philosopher in the Fatimid court.

The identification of the Arabic Liber de orbe reveals that it is one of the earliest works on 'ilm al-hay'a in Western Islam. However, we must note that this work was distinctively characteristic as an 'ilm al-hay'a book, because whereas works on 'ilm al-hay'a normally excluded subjects on the sublunary world, it contained both of topics on the superlunary and sublunary. In fact, it covered the Aristotelian theory of the four elements, geological and meteorological phenomena, planetary motions, and plants. As a result, the Latin Liber de orbe became one of the earliest Latin sources of the Aristotelian physics for European scholars.

Then, we have a question: Why did Dūnash attempt to explain, in a single book, mechanisms, not only of planetary motions, but also of sublunary phenomena, despite he chose the title "Configuration (hay'a) of the Orbs"? By reading through the whole text of the work, we realize his frequent mention of "the creation of the cosmos by the one God", where he connected the rational structure of the cosmos to the "fact" that God had created it, suggesting his aim of writing this book: to show how rational the construction of the world is, which in turn proves that its creation was impossible except by the wisest God. In this presentation, I will clarify the intention of his composing this work by analyzing his arguments where he utilized astronomical phenomena to prove the existence of the one God.

'ilm al-hay'a; Liber de orbe; Arabic; Jewish

On the development of Babylonian planetary theory: from time to position

Teije de Jong, Astronomical Institute Anton Pannekoek, University of Amsterdam

Any answer to the question how the Babylonian scholars arrived at their elegant mathematical theory of planetary motion has to be of a speculative nature because no texts are preserved in which they tell us how they did it. On the other hand, from the surviving Astronomical Diaries we have a complete picture of the nature of the observational material on which the scholars must have based their theory and from which they must have derived the values of the defining parameters. In this short paper I will limit myself to system A theory of the planet Jupiter. I will argue that the development of Babylonian planetary theory was a gradual process of more than a century, starting sometime in the fifth century BC and finally resulting in the appearance of the first full-fledged astronomical ephemeris around 300 BC. The process of theory formation involved the derivation of

long “exact” periods by linear combination of “Goal-Year” periods, the invention of a 360° zodiac, the discovery of the variable motion of the planets and the development of the numerical method to model this as a step function. Because the Babylonian observational information is primarily based on measurements of time and not of position the most difficult but crucial element in the development process is transforming time information into positional information. I suggest that this was done by making use of the relation of the twelve lunar months in a regularly intercalated lunar calendar to the twelve signs of the zodiac. It turns out that this can be done in such a way that the (poorly known) solar elongation of the planet at first and last appearance is averaged out. By analyzing four contemporaneous ephemerides of different synodic phases of Jupiter from the second century BC I further show how the Babylonian scholars may have used observations of Normal Star passages of Jupiter to choose the initial conditions for their ephemerides.

History of astronomy; Babylonian astronomy; Planetary theory

Location of astral sciences in Islamicate societies for the thirteenth and fourteenth centuries

Yoichi Isahaya, The Hebrew University of Jerusalem

We are well cautioned not to apply modern distinctions to pre-modern astral sciences—especially in the case of astronomy and astrology, while there is still plenty of room for further investigation into the social engagement of astral sciences in each pre-modern intellectual milieu. This paper could be a contribution to untangling the complexity of the relation between societies and astral sciences in the pre-modern world, by focusing on Islamicate societies—in particular, Ilkhanid Iran and Iraq, and Mamluk Syria and Egypt—in the thirteenth and fourteenth centuries, when a series of significant achievements were made by Arabic-writing intellectuals in the field of astral sciences. My analysis is carried out on the basis of a prosopographical survey by means of Arabic biographical dictionaries such as *Majma‘ al-Ādāb* by Ibn al-Fuwaṭī (1244–1323) and *al-Wāfi bi-al-Wafayāt* by al-Ṣafadī (1297–1363). In this analysis, I particularly pay attention to the following three points:

- 1) What kind of variety is found in the sources to represent “astral sciences”? For example, the science of stars (‘ilm al-nujūm), the science of the configuration [of the universe] (‘ilm al-hay’a), the science of time-keeping (‘ilm al-mīqāt), the science of astronomical handbooks (‘ilm al-zījāt), etc.
- 2) Secondly, I address the descriptions of astral sciences in the biographical dictionaries, concentrating especially on the relationship with other disciplines, for example jurisprudence (fiqh) and ‘ilm al-mīqāt, or theology (kalām) and ‘ilm al-hay’a.
- 3) As the third point, I also deal with professions mentioned in parallel with astral sciences in the dictionaries, such as: astronomer/astrologer (munajjim), timekeeper (muwaqqit), and so on. The result is visualized using network analysis, which facilitates the understanding of the socio-cultural context concerning the location of astral sciences in the then Islamicate world. This will provide us with certain insight into the Eurasian-scale development of astral sciences.

astral sciences; Islamicate world; 13th and 14th centuries; Ilkhanid dynasty; Mamluk Sultanate

The Indian Outflow Water-clock came to China

Zhou Liqun, School of Asian and African Studies, Beijing Foreign Studies University

The Indian outflow type of water clock is recorded in Sanskrit and Chinese literature, Vedāṅgajyotiṣa>>Kauṭilya’s Arthaśāstra>>Śārdūlakarṇāvadāna>>Modengjia jing (《摩登伽经》).

ICHST
2017

Nālikā/nāḍikā is used instead of ghaṭī/ghaṭikā gradually. This type of water clock was introduced to ancient Chinese people by Buddhist and Taoist.

water clock; Outflow; Ancient India

The "Watches of the Night" and the Spread of Astral Knowledge from Local to Global

Zoë Misiewicz, ISAW-NYU and SUNY Oneonta

Astral texts ranging in time and space from Old Babylonian Mesopotamia to Late Antique Constantinople make use of a tripartite division of the night into three “watches”. This schema is given ominous significance in divinatory texts written in both Akkadian and Greek, which consider the position and appearance of the moon in order to make predictions about events on earth. The Akkadian texts that apply this schema to divinatory ends are relatively numerous and chronologically widespread, extending from the Old Babylonian period until at least the Neo-Assyrian period, while in Greek this specific usage is much more limited: references to the “morning watch” in particular appear most notably in John Lydus’ sixth-century CE work *On Celestial Signs*. By considering more carefully the various Greek contexts in which phrases such as “morning watch” appear, we can observe the interplay of local and global ideas in ancient astral texts.

astronomy; astrology; divination; Greek; Akkadian

005. Critical, radical and postcolonial geographies and cartographies from early approaches to present-day debates

After the Excitement of War: The Situation of Sick and Wounded Soldiers (Invalids) in Japanese Modern Society

Akio Onjo, Kyushu University

An ‘all-out war’ has had many serious effects on the whole human ideas and activities in modern and contemporary world. These effects ranged from the soldiers in battle fields to the ordinary people at the home backing up the armed forces. Military installation has also influenced an economic and social structure, and cultural dynamics in local context. This paper aims to examine the contradictory effects of an all-out war on the processes of the modernization of Japanese society and the imperialistic nation-building.

The Russo-Japanese war (1904-05) was the first all-out war that the Japanese nation experienced. This war aroused fanaticism in the nation. For example, many people organized and participated in the parades for celebrating the victory of each battle, especially in the city. Even national governmental officers recognized this exaggerated enthusiasm ‘from below’ as very dangerous drift. It was this war that led the Japanese society to the imperialistic disposition and boosted the imperial consciousness of the people as ‘First-Rank Nation’.

After finishing the war, a lot of sick and wounded soldiers returned to their home. At first they were welcomed as the ‘bravery emperor’s soldiers’ by the people. But wounded soldiers, especially lower-class one, were not able to spend everyday life by their own selves as well as work normally. As some wounded soldiers felt that they were abandoned by the people as well as the government, they got into violent troubles. So they were treated as ‘burden’ or ‘social question’ because of their economic poverty and social unrest.

It seems that many people would wish to exclude the existence of wounded soldiers from their

‘normal’ society. Because they felt that the figure of ‘physically handicapped men’ made them remember the misery reality and memory of the war which didn’t suit the geographical imaginary of ‘Newly Imperial Japan’.

This war had the contradictory influence that made a strong sense of unification among the nation on the one hand and some deeper gaps into Japanese society on the other. By highlighting the situation of sick and wounded soldiers, this paper traces the some aspects of the geography of peace and war in the scale of everyday life.

War, Wounded Soldiers, Japan

Territories of Solidarity: The sociability of mutual aid in both time and space

Amir El Hakim de Paula, UNESP

One of the main aspects of Kropotkin's work is his analysis of the territorial layout that many human communities had in their evolutionary processes, mainly their mutual aspects.

More than acknowledging the diversity of human occupations that emerged, he sought to discuss them in order to highlight their sociability, showing that these main aspects defined the capacity of human beings to organise themselves.

By carrying out this task, Kropotkin tries to present mutual aid as a natural fact and a constituent source of many types of spatial and temporal organization, as well as an intrinsic part of humankind. To realise his main purpose, i.e. to demonstrate the existence of a predominance of mutual aid as an organizing factor in several human societies, Kropotkin built a pattern of peculiar understanding in which territories of mutual aid arise from a struggle against both natural storms and social stance based on power and hierarchy.

In this process of creation of these mutual aid partnerships, the solidary sociability appears. It is based in anti-competitive, communalist and democratic values, allowing the progress to be always guided by agreement.

Emerging in a particular location, it has its own dynamic, a different territorial appropriation, which Kropotkin calls territorial principle.

On my mind, this territorial principle expresses a territoriality, because it is founded in mutual aid, it has as substrate the solidarity among individuals, and it enables a greater capacity of individuals to overcome the daily challenges.

This is how I understand the Kropotkin's work in analysing the mutual aid among the ‘barbarians’ or so-called ‘savages’, but also among the workers of his age, trying to rescue the presence of a supportive stance in several historical periods and farther geographical places.

In this sense, it seems that these territorialities were hegemonic in some historical ages (in the case of medieval communes) and residual when the process of industrialization in the nineteenth century happened (restrict to the working class and the poorest people).

Analysing the presence of the solidary sociability that is embodied in the territory in a time markedly dominated by capital sociability allows us to grasp the work of a geographer who is still little discussed in the Brazilian academy, although he gave a strong geographic contribution.

Kropotkin; Territory; Mutual Aid

Jaime Cortesão and the Indigenous knowledge in the exploration of Brazilian Territory: Hidden Postcolonial Geographies?

André Reyes Novaes, State University of Rio de Janeiro

The Portuguese historian of cartography Jaime Cortesão (1884 – 1960) was often quoted as an important reference by Brazilian geopolitical authors. Military scholars from the second half of the twentieth century, such as Golbery do Couto e Silva and Carlos Meira Mattos, usually evoked Cortesão in order to elucidate historical aspects about exploration and support narratives on how the "Portuguese blood" was important for the Brazilian territorial formation. However, other aspects of the author's work have been increasingly studied, evidencing how his narrative highlighted the importance of indigenous knowledge in territorial exploration. This paper seeks to build bridges between postcolonial theories and Jaime Cortesão's writings on indigenous knowledge from the 1940s. The agency of indigenous peoples in the conduct of expeditions has been often studied in contemporary geography. A well-known example is Driver and Jones exhibition in 2009, seeking to present new ways of looking to the Royal Geographical Society archives and show some "Hidden Stories of Exploration". The exhibition was part of a wider project designed to challenge a dominant narrative in the history of exploration, which privileges the actions of heroic individuals in extraordinary circumstances. In contrast with this narrative, Cortesão showed some concerns on the indigenous knowledge and techniques learned by the Portuguese in order to circulate over the South American territory. Cortesão's interests on the role of indigenous people in exploration was evident in several articles that the author published in the press between 1947 and 1948 under the title "introducing the history of the pioneers". The second chapter of his famous book, "History of Brazil in Old Maps", also clearly shows this concern, and it was entitled "pre-historic foundations: the aborigine and its relation with the land". This chapter was completely dedicated to show how the Indians had a spatial cultural and already circulate in different parts of South American territory. Which maps and historical documents were chosen by Cortesão to highlight indigenous participation in territorial exploration? Which references does the author mobilize to discuss this topic? How this part of Cortesão's work was silenced in military books on Brazilian geopolitics? By considering these questions, I will seek for paths to read Cortesão's historical narratives with postcolonial eyes.

Postcolonialism, indigenous mapping, territorial exploration

LA RÉUNION DANS LES ATLAS COLONIAUX (1821-1939) Une autobiographie nationale

Christian Germanaz, Université de La Réunion

Au cours du XIX^e siècle, l'expansion coloniale des puissances européennes a pour corollaire implicite, un nouvel engouement pour la géographie parmi les élites politiques, la bourgeoisie et chez les entrepreneurs industriels. En France, il faut attendre les années 1850 pour que cet intérêt à l'égard des « horizons lointains » touche progressivement une population plus large sous l'impulsion des grandes revues illustrées, comme l'Illustration ou le Tour du Monde. Parmi cette production éditoriale florissante, le genre de l'atlas connaît un grand succès soutenu, en partie, par l'essor du mouvement colonial après 1870. Si nous pouvons situer « l'âge d'or » des atlas coloniaux entre cette date et les années 1930, certains peuvent être identifiés plus précocement, dès 1820, par le fait qu'ils intègrent dans leur corpus la présentation des « vieilles colonies », à l'image de La Réunion dans l'Atlas Portatif de Tardieu-Denesle (1821).

La « fabrication » de l'Atlas (colonial) repose assez souvent sur un modèle éditorial bien établi et la multiplication des éditions laisse parfois chez le chercheur un sentiment de répétition aussi bien au niveau du dispositif cartographique que dans les informations (statistiques) présentées par les

auteurs. Constatant que ces atlas reprenaient en écho et sans perspective critique une formulation cartographique de l'île presque identique et n'apportaient pas ou peu de nouvelles données pour suivre l'évolution de la construction cartographique de La Réunion entre 1850-1910, nous avons repoussé provisoirement leur étude. La suggestion de dé-construire les cartographies impériales proposée par le comité du 25e Congrès de l'histoire de la science et de la technique, nous donne l'occasion de renouer avec cet objet singulier que constitue l'atlas colonial.

En choisissant comme cas de figure l'île de La Réunion, notre soumission mobilise la diversité du corpus des atlas de la France et ses colonies, produit entre 1821 et 1939, afin d'identifier les différents topos coloniaux véhiculés au sein de ces ouvrages. En nuanciant l'hypothèse radicale d'une propagande impérialiste à leur propos, nous souhaitons dé-construire les propositions cartographiques exposées dans ces atlas en les confrontant aux « renseignements » qui les accompagnent pour faire émerger les figures du discours impérial et leur transformation successive dont l'appréhension diachronique (1821-1839) formule une autobiographie nationale du fait colonial.

Atlas du XIX^e ; Cartographie coloniale; Figures du discours colonial; Île de La Réunion

Controversial cartographies: science, technique and ideology in forest cartography (Chile)

Enrique Aliste, University of Chile

Cartography, as an instrument of analysis, orientation, planning, domination and management, has several controversies in different areas. Normally the text resulting is a controversial document for a large analysis of context, meanings depending of nature of contents.

The purpose of this work is explore the many conflicts in the cartographic production about the land use in forest areas in Chile, and the objectives are: analyses the scientific arguments of this productions, and, in other hand, explore the different arguments that do not belong to the scientific field. One of the question is: what kind of reason do you have to impose a certain way of reading of the space by this kind of instruments?

Cartography; forest; controversies; Chile; conflicts

Geography, Anarchism and Republicanism: Elisée Reclus studying Brazil (1862-1905)

Federico Ferretti, University College Dublin

During his career of geographer and militant, Elisée Reclus (1830-1905) dedicated many hundreds of pages to Brazil, and some of them eventually became the first geographical monograph of the country, once traduced into Portuguese and edited as independent volume by Barons Rio Branco and Ramiz Galvão, in 1900, under the title Estados Unidos do Brasil.

Drawing on current literature on geographical invention of national identities and on national and anti-colonialist imaginations, I analyse the Reclus's corpus on Brazil, as well as his relations and correspondences with Brazilian and South-American scholars. My main argument is that Brazil was a privileged field of application for Reclus's political and geographical ideas, due to the exceptional social and institutional transformation that this country witnessed during the period of Reclus activity.

In the first part of my paper, I address Reclus's writings on Brazil in the 1860s on the French journal *La Revue des Deux Mondes*. In this period, Reclus harshly criticized the permanence of slavery and of imperial institutions in Brazil, also regretting that the 1864-68 "War of Paraguay" did not lead to an alliance of South-American federal republics against Brazil. Consistently with his federalist program,

Reclus was eventually in touch with Argentinian authors then in touch with the autonomist movements in the provinces of Entre-Rios and Corrientes, and wished for something similar in Brazil. In the second part, I address Reclus's chapter on Brazil for the *Nouvelle Géographie universelle*, published in 1894. After the abolition of both empire and slavery in 1888-89, Reclus's views on Brazil changed radically, and the anarchist geographer started to appreciate Brazil as the laboratory for universal miscegenation, that he saw as the solution against racism. Reclus also praised the introduction of a federal republic, though criticising its contradictions such as social inequalities and lack of real democracy.

In the third part I analyse the last Reclus's work, *L'Homme et la Terre*, praising global migration and especially the establishment of transnational anarchist and socialist workers in South America as a part of the accomplishment of his internationalist and cosmopolite program.

I conclude by arguing that historical links between anarchism and the traditional republican idea of "liberty as non-domination" allow understanding the interest of an anarchist for Brazilian political institutions.

Elisée Reclus; Anarchist Geographies; Republicanism; Anti-colonialism

Une ouverture sur le monde... et sur soi-même: l'inégale couverture spatiale de Geo et de National Geographic magazine

Guilhem Labinal, Université de Cergy-Pontoise

Certains territoires sont peu couverts par les médias ; des travaux plus nombreux rendent compte des hiérarchies qui existent dans la presse et sur Internet. Si l'on s'intéresse aux magazines grand public de géographie, anciens et récents, un travail sur les index conçus par les éditeurs permet d'identifier les angles morts du monde décrit au fil des numéros ; les disparités observables peuvent constituer des indices exploitables pour mieux saisir la nature des représentations livrées aux lecteurs. C'est, du moins, ce que nous proposons de montrer à partir des index associés à deux publications dont la diffusion est restée importante, *National Geographic magazine* et *Geo*, en nous interrogeant sur la pertinence de l'examen de leur couverture spatiale à l'échelle étatique sur une trentaine d'années de parution (des années 1980 à la fin des années 2000). Ce faisant, nous identifierons les limites imposées par la convocation des index.

Dans la version américaine de *National Geographic magazine*, les pays de l'Amérique du Nord et les Caraïbes font l'objet de reportages plus nombreux que dans *Geo*. L'effet de voisinage est évident mais il n'explique que partiellement les sélections : le développement touristique, les potentialités d'étude scientifique, l'actualité internationale ou la puissance des États éclairent aussi les choix réalisés. Dans *Geo*, la France et les territoires francophones sont abordés fréquemment ; la couverture spatiale proposée est indissociable d'un imaginaire ouvert sur l'ailleurs mais qui renvoie - d'abord et avant tout - à soi-même. La cartographie des sur- et des sous-représentations spatiales contribue à préciser le système de représentations par lequel un magazine se singularise, dès lors qu'elle est couplée à l'analyse de la façon dont les territoires sont appréhendés. Contrastant avec *Geo* qui est ancré dans le voyage plutôt que dans l'exploration, *National Geographic magazine* a développé une nostalgie, vivace, imputable au rétrécissement du monde pour retrouver les explorations du passé. Des explorations renouvelées mais sélectives car les zones blanches subsistent.

Il est utile d'observer, de façon critique, ce qui occupe une place évidente dans l'orientation du rapport au monde que les magazines véhiculent : la présence ou l'absence des territoires auxquels ces derniers s'intéressent. Mais il reste nécessaire d'étudier, au-delà, la façon dont les sujets sont construits pour saisir les effets de sens qu'ils induisent.

couverture spatiale; magazines; représentations; cartographie; ethnocentrisme

“Unsinkable aircraft carriers”: Chagos and the Maldives

Marcella Schmidt di Friedberg, University of Milano-Bicocca

Stefano Malatesta, University of Milano-Bicocca, Italy

In 2009, R. Kaplan defined the Indian Ocean region as "the central internship for the challenges of the twenty-first century". For Bouchard and Crumplin (2010) the Indian Ocean must be "no longer neglected" within the international scenario. The driving forces leading to this crucial historical transition are linked to the relations between the "big players" of the regional chessboard: the US, China, India and Saudi Arabia. Both the geographical nodes where these relations take place and the new narratives defining the geographical imaginary of the region are key objects to understand the contemporary historical processes.

Pearson (2003) and Alpers (2014) also reinforce the relevance of this analysis. In their volumes on the Indian Ocean history, they emphasize the balance between these geopolitical forces, the regional centrality in the contemporary processes of globalization, and the environmental challenges as the key-drivers to understand the geographies of the region.

Our contribution addresses the main historical and geographical processes that led to this transition: the renewed centrality of the Indian Ocean, the Sino-Indian rivalry (Brewster 2015) and the geopolitics of environmental crisis. We focus on the two archipelagos (Chagos and the Maldives) that act as the "unsinkable aircraft carriers" of the region. Furthermore, we mention the role and the ideologies of the international agencies, as new "main characters" of the political and geopolitical landscape of the region.

Kaplan reminds us that "the 70 percent of the total traffic of petroleum products passes through the Indian Ocean," (2009), and Bouchard and Crumplin drew a cartography of the region based on the connections among the "choke points", underling the importance of the regional maritime space both for the grown of a great number of Asian economies, and for the Sino-Indian rivalry.

Over the last decades, Chagos and the Maldives have been central nodes of this geopolitical cartography. In 1971, the United States Navy built the military base on Diego Garcia and, since the beginning of the "Indian Ocean Cold War", the Maldives has been acting as a fringing space between the Indian military supremacy and the Chinese influence within the economies of peripheral counties. This allows us to investigate the contemporary transitions into the post-colonial studies and to propose an alternative reading of the conflict for hegemony currently happening between the "big global players".

Strategic position, Indian Ocean, Chagos, Maldives

The origins of Critical Geography in Latin America

Maria Verónica Ibarra García, UNAM

Alejandra Peñas García, Instituto Mexicano de Tecnología del Agua

Edgar Talledos, Colegio de San Luis

In the Latin American region, since the 40's of the XXth century, it is possible to identify a segment of the geography discipline interested in poverty, inequality and social injustice research topics. The practitioners of this kind of geography were people who took a stance -since then- in favor of the most vulnerable of society. Nevertheless, very little has been analyzed about this chapter of our institutionalized discipline. This work has the aim of documenting the scientific and political trajectories, as well as the academic work, of some prominent Latin American geographers, who were the pioneers of a critical and libertarian school of thought and work, in an open opposition to the traditional geography tied to the State and in favor of the status quo. Geographers of four different countries will be presented: Brazil, Cuba, Chile and Mexico, with the purpose of developing into their academic and political work, and production. It is of the highest importance, due to the fact that these professors influenced and motivated

the search of new theoretical and conceptual frameworks, and methodologies in geography, which in turn led to open the discussion of new topics in favor of a better world.

Latin America, libertarian perspectives, critical geography

Pacifying the border. Violence, conflicts and peace arguments in border regions during demarcation processes in 19th century Iberian Peninsula

Paloma Puente Lozano, Carlos III University of Madrid

Jacobo García-Álvarez, Carlos III University of Madrid

From Walter Benjamin to Max Weber, Jaques Derrida or Michel Foucault and Giorgio Agamben, 20th century critical thinkers interested on state, law and political power have put a great emphasis on the fact that the link between violence and law have play an integral role in practices of foundation and legitimation of state legal order and is inherent to liberal political imagination, regardless how liberalism conceives itself violences of state law. Political geographers have long developed an analysis of the different spatialities implied within this link, notably regarding state-building. Particularly, over the last decades “critical legal geography” has put forward an analysis of geographical enactments of law and its violences, by showing the link between legal and geographical imaginaries prevalent in modern states. The issue of borders and boundary making have been central to these analyses, as border areas have proved to be particularly problematic and contested spaces within larger process of state territorialisation, because of both the complexities of long-standing social, legal and political conflicts and the variegated spatialities inherent to border itself.

Our presentation aims firstly to analyse the role of violence within boundary-making, by focusing on 19th century demarcation processes in Iberian Peninsula, and notably the conflicts proper to Spanish-Portuguese boundary. By proposing a typology of boundary socio-territorial issues we aim at examining the different nature of the problems that existed in these border areas, and how modern boundary treatises tried to come to terms with these different kinds of unrest and to give them an answer. Our paper also aims to critically analyse the role of “pacification” argument within modern boundary making discourses. Bringing peace to borderland local communities was one of the main objectives of Iberian boundary treatises, and the pacification of these regions was stated as integral to boundary-making itself. Examining the role of this pacification discourse against the backdrop of the different types of violence associated with border regions, as well as the role played by state, regional and local agents within these conflicts, is important if we are to understand how borderland were made amenable to governmentality and in what sense violence –the same as peace arguments– were part of this process.

Border; Iberian Peninsula; 19th century; violence; critical legal geography

Speeches and maps around the water problematic

Rogata Soares Del Gaudio, UFMG

Eliano de Souza Martins Freitas, UFMG

Doralice Barros Pereira, UFMG

This paper aims to make an analysis of the construction of cartographic discourses around the water problematic – using the Discourse Analysis methodology – in an important magazine about scientific communication, which moves in all Brazilian territory, called *Ciência Hoje*. The period of our analysis extends from 1990 until 2016.

The choice of this magazine, a publication of Brazilian Society for the Science Progress, is justified for its appeal as an important communication vehicle for a common public. This magazine is published on a monthly basis and approaches many subjects about Science, broadcasting them for a wider audience, promoting the topic with easier comprehension. Specifically, our “corpus” is constituted by analysis of maps and images concerning the water subject in this magazine. We understand that the maps and images are, like other signals and symbols (Bakhtin, 2006), builders of discourses at and about the reality (Del Gaudio, 2003) and more than that, for their character of “truth” (Foucault, 2007), produces the understanding of this reality through different interpellation mechanisms - “truth” which is presented in the selected magazine. According to Therborn (1991, p.16), the many ways of interpellation allow us to understand “what exists and his corollary, which not exists, who we are, what is the world, which is the nature and the society”; they permit yet building affirmations about “what is good, correct, just, beautiful and all his contraries”; and lastly, allows the comprehension about what is possible to change or not”, consenting in the building of sense of permanence and mutability to determined order/condition/society. The choice of periodicity is related to the construction of discourses around the water topic, starting with the realizations of many Environmental Conferences, specially the Conference of Rio 1992, when we observed the emphasis in Sustainable Development. We ask: what is the content in these discourses around the water? Was there any change? If so, what changed? How do the maps and images present in this magazine reflect/refract (Bakhtin, 2006) in these discussions? What was silenced (Orlandi, 2007) in these maps and images, and simultaneously, helped the construction of conceptions related to the water currently?

Ciência Hoje Magazine; Water; Discourse; Ideology

Resonances of the Treaty of Madrid (1750) and San Ildefonso (1777) in the readings on the formation of the territory of Argentina and Brazil

Perla Zusman, Conicet/University of Buenos Aires
Sergio Nunes Pereira, Federal Fluminense University

The treaties of Madrid (1750) and San Ildefonso (1777) signed between Spain and Portugal to define the intercolonial border in South America had different effects on the literature produced in History and Geography in Argentina and Brazil. Our approach distinguishes three lines of research.

The first line is related to geopolitical studies. These studies understand that both treaties acquired a key role in the outline of the borders of countries situated around the River Plate. Differences between current international borderlands and the one proposed by these treaties should be read in terms of territorial gains or losses. This perspective naturalizes territories and ignores the historical and political processes that took place in South America between the end of the XIX th century and the beginning of the XXth century.

The second line emerges from the studies of History of Science and Technology. This perspective considers that the treaties of Madrid and San Ildefonso resulted in the actions of the Boundary Demarcation Commissions that created a certain background in terms of skills and knowledge. Practices of the Commissions involved in the process of defining the boundaries of Argentina and Brazil would interplay with this background. In this sense it's conceived that the conformation of the colonial territory and the one of the States organized between the XIXth and XXth centuries involved different and specific geographical and political processes. This constructionist perspective of the territory seeks to differentiate itself from the naturalistic one aforementioned.

The third line results from studies developed in the History field around 1980s. Within this vision it's possible to identify analyses that deal with particular processes like smuggling dynamics around Colonia of Sacramento (XVIII th century) or forms of organization of Guaraní missions during the same period. Within this perspective it is considered that both agreements reshaped relations between actors and practices that took part in the organization of these spaces. The national

approach that permeates the first and second lines of research is displaced here in favor of a regional approach. Our contribution attempts to deepen the analysis of the ways through with the three lines of research discuss both treaties. In turn, it seeks to understand the conceptions of the territory and the nation that underlie these perspectives.

Argentina; Brazil; frontier; Treaty of Madrid; Treaty of San Idelfonso

Drone images and geographical imaginations

Verónica Hollman, CONICET/University of Buenos Aires

Although drones were originally developed as a military technology, they are currently more accessible and sophisticated. These flying cameras offer, as we have been experiencing since the early association of photography and flight, the possibility to depict places from perspectives rather difficult or even impossible to have in a direct way. Cheaper to have and easier to ride there is no doubt that drones widen the experience of producing vertical and horizontal images. Familiarity with aerial imagery has stimulated both the production and the demand for drone images. The massive production of drone pictures and videos becomes a visual universe per se that largely exceeds its military origin. In addition, the digital materiality of these pictures promotes a wider circulation of the aerial perspective.

Drone images have improved their quality on the one hand, due to the achievement of more stable, autonomous and safer flights; on the other hand, due to the introduction of more sophisticated cameras. However this improvement is not just a technological issue. Some amateur drone photographers' accounts suggest that the contribution of aerial imagery in the production of current aerial visual universe should also be acknowledged.

Most of these images are characterised by an immediate aesthetic appeal that turns out to be effective in a plethora of discourses and practices that go beyond military ones. Despite this fact, most of the literature about drone images have focused on their relation to war and military surveillance (Derek, 2011; Hall Kindervaten, 2015). I am particular interested in the non military production and circulation of drone images. I will argue that both the non military orientation and the realistic character of these drone images contribute to understand and use them as unproblematic images.

Aiming at analysing the geographical imaginations that are produced, organised and circulate through non military drone images I will focus on two websites in which amateur and professional photographers upload both photographs and videos taken from drones. I will explore the visual architecture of the images displayed, the categories proposed to classify and organise them and the sort of promises that drone aerial vision entails. Despite recognising the new setting opened by drone image, I will trace its links with other aerial images produced and used in the history of Geography as a corpus of knowledge.

drone images; aerial vision; non-military use; geographical imaginations

006. Geography as an international science: historical perspectives and present challenges

Desmarest's physical geography article in the Encyclopedia of Diderot and D'Alembert: a preliminary approach

Alexandre Henrique da Silva dos Santos, São Paulo University
Manoel Fernandes de Sousa Neto, São Paulo University

There are few works about the history of Physical Geography. Generally, this subject is treated as a simple old name for Geology or it is completely dissolved in the History of Geography.

This paper is an attempt to rescue a little part of its history. For this, we will discuss the Physical Geography article published in the Diderot and D'Alembert's french Encyclopedia of Eighteenth century. In this first approximation, we will try to answer some questions like: "Who was the author that wrote this article and why?", "What were the philosophical ideas present in this text?" and "Is it possible to see an intellectual filiation with the ideals of French Enlightenment?"

All these questions are interconnected and it is virtually impossible to answer them independently. The author of the article, the french savant Nicolas Desmarest, or Desmarets, apparently was recruited by D'Alembert to write specifically about physical geography.

Desmarest was a protégé of D'Alembert and this helped him to access the French state bureaucracy. Throughout his carrier, he was the manufacture inspector of the many french cities, member of various Académies and commerce bureaus.

His article about Physical Geography was published in 1754 and demonstrates two important aspects of the new science and the French enlightenment: a mechanical vision of nature and the belief in experimentation and observation of nature like the only way to know it and make universal proposals about how it works. In this aspect, Desmarest is making a disenchantment of the natural world, if we could utilize a Weber's expression.

Furthermore, Desmarest's article reveals more than the traditional eighteenth century scientific theories influences. The philosophy of the catholic religious order called Oratorien Congregation has an important aspect in the legitimation and elaboration of this article. Particularly, some ideas of the father Malebranche, the major philosopher of this Order, is present.

In a preliminary conclusion, it is possible to interpret this article as a theory of how earth phenomena (like volcanism, fluvial erosion and others) must be researched and comprehended according to the french savants encyclopedists.

Finally, considering the great success of the Enciclopédie in the Europe, we believe that the contribution of the Desmarest's article to the internationalization of the geographical knowledge, mainly the French geographical knowledge, is a subject that deserves more attention.

Desmarest; Encyclopedia; Physical Geography; Enlightenment

(Re-)Writing the History of IGU? A Report from the Archive

Bruno Schelhaas, Leibniz Institute for Regional Geography
Stephan Pietsch, Leibniz Institute for Regional Geography

The International Geographical Union (IGU), the international organization for geography, was founded in 1922. In its almost 100-year history, and even in the decades before, the involved geographers produced a great number of printed as well as non-printed material. Besides the self-experienced and individual IGU history, the written (and visual) tradition offers a unique basis to analyze and reconstruct an important part of international geography in the 20th and 21st century. International scientific organizations are always political organizations. Therefore, the sources derive from a specific political environment and mirror not only the development of modern geography but also science policy in difficult times during peace and war and the Cold War, too.

After Paris, London and Rome the IGU Collection has a new home at the Leibniz Institute for Regional Geography in Leipzig. The cataloguing and indexing has just begun. In general, we deal with two kinds of media within the IGU-Archive: (1) printed and handwritten textual documents on paper and in digital formats as well, and (2) audio-visual documents, a few photographs and especially video tapes and digital copies containing interviews. For every kind of these sources, a different kind of storing

and analyzing has to be developed.

The archival recording is unfortunately incomplete: the documents before 1956 are missing, and even after that and partly until today there are striking gaps in the collection. This needs an explanation and should be considered for the management of the collection in the future. The actual IGU activities are the basis for the archive in the near future!

In our presentation, we will give an insight into the IGU Archive, especially with a focus on the possibilities and limits of (re-)writing the history of the International Geographical Union and international geography in general. Moreover, we will concentrate on the question which kind of documents can be used to reconstruct which kind of history. This seems to be important, in order to create a vivid narration of a big scientific organization.

History of Geography; International Science; Archival Sources; Historical Methodology

Hans Steffen, a Prussian geographer in the Chilean Andes. Circulation of theories, scientific practices, fieldwork and instruments to reinterpret the legacy of the colonial frontier and draw the boundary between Argentina and Chile (1889-1914)

Carla Lois, CONICET

Hans Steffen, a prominent Prussian geographer (1865-1936), was initially hired by the Government of Chile as professor of geography for the recently formed Pedagogical Institute to create geography professors and write texts that contributed to the institutionalization of geography in that country. He was also asked to make a physical geography of the country, to raise astronomical observations and to perform topographic mapping, as well as to collect specimens of botany and zoology.

When Chile and Argentina decided to submit the border dispute over the Andes to international arbitration, Steffen contributed to the Chilean lawsuit. He made expeditions with instruments brought from Europe, wrote texts in which he proposed to define western Patagonia in geomorphological terms, he presented the results of his work to the Royal Geographical Society, he maintained a smooth correspondence with the Argentine expert Francisco Moreno, he answered the Argentine postulates (based on the natural border Ratzelian theory) and even began to do triangulation works which he left unfinished when he returned to Switzerland due to health problems.

This presentation analyzes the ideas, theories and geographical practices developed by Steffen for the conceptualization and demarcation of the border between Argentina and Chile by examining the texts he produced (newspapers, didactic books, diplomatic declarations, published conferences), images (maps, photos, sketches, outlines and field notes) and the social impact of their practices (for example, appearing in annals and scientific journals, or in periodical press). What juridical doctrines, geographical theories and cultural traditions did the new independent countries (in this case Chile and Argentina) assume to define the limit in relation to the legacy of the colonial inheritance? How were *uti possidetis iuris* positioned before the beginning? And in relation to this: what analogies and differences can be established between colonial and postcolonial cultures and traditions, and between Latin American and European ones? What implications had the participation of European specialists (as in this case Steffen) in the Latin American demarcation works during the republican period? These are some of the questions that this presentation aims to answer.

Steffen; Patagonia; border

Centres of circulation: academic mobilities and imaginative geographies of academic conferences in Brazil, 1986-2013

Christiane Fabíola Momm, Regional University of Blumenau - FURB
Heike Jöns, Loughborough University

Conferences play a crucial role for academic communication, interaction, and knowledge exchange. In this paper, we conceptualize academic conferences as temporary 'centres of circulation' by bringing into conversation interdisciplinary debates about the geographies of knowledge with a focus on Latourian centres of calculation, temporary clusters, and diverse (im) material mobilities. Drawing upon a case study of ENANPUR and SIDR, two major conference series on urban and regional development and planning in Brazil, we show how the venues of conferences shape regional clusters of contributors and their papers' imaginative geographies. Focussing on urban and rural development, respectively, the two conference series' locations reinforced their roles as centres of circulation for two distinct epistemic communities as well as diversifying recruitment areas and imaginative geographies. We therefore argue that academic conferences are an important tool for urban and regional development and planning because they put places and people 'on the map' of academic communities and policy agendas.

Conference; Temporary cluster; Knowledge transfer; Geographical imagination; Brazil

Brazil: a semi-colonial space for French geography? The case of Pierre Monbeig and Pierre Deffontaines in the interwar years

Ian Merkel, New York University

In this paper, I consider Brazil's impact on French geography in the interwar years, focusing on the work of Pierre Monbeig and Pierre Deffontaines. These geographers, who taught at newly founded Brazilian universities, applied concepts such as *mise-en-valeur* to understand Brazilian human geography. (*Mise-en-valeur*, literally valorization, was a term coined as part of a larger effort to make the colonies more self-sufficient and profitable.) I trace concepts common to French colonial geography to understand how Monbeig and Deffontaines conceived of Brazil both in comparison and in contrast to Europe's colonies.

Brazil may have been a semi-colonial space for Monbeig and Deffontaines, but it also differed structurally as an independent nation with a bourgeoisie interested in supporting geographical research. I argue for the epistemological importance of this for the evolution of French human geography. If on one hand, Brazil's tropical ecology and labor organization centered on export markets fit clearly within the frame of French colonial geography, Brazil contributed much more than an object of research to international geographical science.

I analyze the contributions that Brazilians made to the research of French geographers such as Monbeig and Deffontaines at various levels: governing elites, in creating an intellectual space and teaching jobs for French professors; state governments and private organizations, in financing geographical expeditions such as Monbeig's travels in the interior of São Paulo and Goiania and Deffontaines's in Rio and Minas Gerais; and finally, students and assistants who accompanied them on their expeditions. By inviting, funding, and working alongside French geographers, Brazilians created an autonomous space for French geography, relatively free from the political exigencies of colonial geography and from the increasingly technical aspects of North American geography. The Franco-Brazilian geographical cooperation in the interwar period allowed for the growth of human geography in the footsteps of Jean Bruhnes and Albert Demangeon—a tradition that was largely being questioned in France itself.

Geography as an international science. Reflections from the IGU Centennial Oral History Project

Jacobo García-Álvarez, Carlos III University of Madrid, Spain

Michael S. DeVivo, Grand Rapids Community College, USA

Jean-Yves Puyo, University of Pau and Pays de l'Adour, France

As the International Geographical Union (IGU) celebrates its 100th anniversary in 2022 and the 150th jubilee of International Geographical Congresses will take place in 2021, a working group made up of several international experts within the field of the history of geography was founded in February 2016 at the Leibniz Institute for Regional Geography in Leipzig on the initiative of the IGU Executive Committee. The main goal of this group consists in elaborating a book not only on IGU history but, more broadly, on the internationalization of geography in the last 100 years, examined from a critical perspective. Within the framework of this project, a series of recorded personal interviews to senior scholars who have held or hold positions of responsibility inside IGU executive committees, commissions and national delegations has been envisaged, on the basis of a model questionnaire structured into three parts, namely: 1) Personal background and beliefs; 2) Internationalization of geography, geopolitics and science policy; 3) Role of the IGU within the process of internationalization and future of geography. The first twelve interviews made for this project were conducted on the occasion of the 33rd Geographical International Congress, which was held in Beijing on August 21-25, 2016. Having participated in the conduction of those interviews, the co-authors of this paper aim to present some of the key issues and preliminary results from this initial oral history survey.

geography; international dimension; oral history, IGU

Qu'est-ce c'est un intellectuel français en mission internationale? Le cas de la mission française envoyée au Brésil (1934-1940)

Larissa Alves de Lira, USP/EHESS

Entre 1934 et 1940, une mission française est envoyée au Brésil, pour aider à l'organisation de l'Université de São Paulo, fondé en 1934. En se concentrant surtout sur le domaine de sciences humaines, cette mission était composée de quelques jeunes intellectuels qui seront reconnus plus tard au sein de leurs domaines de recherche : Pierre Monbeig (géographe), Fernand Braudel (historien), Claude Lévi-Strauss (anthropologue), Jean Maugué (philosophe), Paul Arbousse-Bastide (sociologue), Roger Bastide (sociologue), entre autres. Dans cette communication, nous présenterons les trajectoires, les stratégies collectives et individuelles, les conflits, les divers groupes qui se sont formés, la construction des carrières universitaires et les relations avec quelques acteurs brésiliens dans le cadre d'une mission française internationale. L'internationale, pour ces acteurs, est vue comme l'insertion dans une mission, la connaissance possible des nouveaux milieux et terrains. Cependant, quels sont les principaux problèmes qui déterminent l'institutionnalisation de ces processus d'internationalisation ? Ces jeunes intellectuels étaient partagés : ils se liaient au présent au Brésil, mais ils avaient comme perspective le retour en France. Lévi-Strauss rappelle que, au Brésil, ils semblaient jouer la scène d'une carrière universitaire future. Ainsi, chacun a établi un lien spécifique avec ce pays neufs et d'une certaine manière avec la France qu'ils avaient quitté, révélant les conflits d'adaptation et les diverses stratégies que chacun avait en s'insérant dans une mission

universitaire pour l'étranger. Ces stratégies vont marquer la manière dont ces intellectuels ont construit ses pratiques d'enseignement et recherche dans le cadre d'une coopération internationale.

Intellectuels français; mission internationale; Brésil

Holistic Geography and German Idealism: A Study of the Wahlverwandtschaften Alexander von Humboldt's and Carl Ritter's

Leonardo Arantes, Universidade Federal Fluminense

Originally conceived in the last third of the 18th century as expression of the multiple possible (dis)connections of the matter in the physicochemical world, the concept of Wahlverwandtschaften (elective affinities) was used by Goethe in the early 19th century as title of one of his works on Human, affective and matrimonial relationships in "Germany" based on his own personal relationships and dilemmas. In this nouvelle, Goethe expressly pay tribute to his friend, considered by him one of the greatest and most important naturalists of his time, Alexander von Humboldt.

Approximately hundred years later Max Weber (Die 'Objektivität' sozialwissenschaftlicher und sozialpolitischer Erkenntnis. In: Archiv für Sozialwissenschaft und Sozialpolitik. 19 1904, S. 22–87, GAW 146–214) used the same term to express therefore the way how the fusion of different cultures, worldviews and epistemologies can produce new ways of thinking, that can be extremely fruitful. Following and developing this conceptualization elaborated by Weber, Michael Löwy (Rédemption et utopie : le judaïsme libertaire en Europe centrale : une étude d'affinité elective. Paris: Presses universitaires de France, 1988) investigated a particular kind of established relation between Jewish messianism and libertarian utopia in Middle Europe by the end of the 19th and beginning of the 20th century. He found there an expressive mix that produced thinkers so different, nonetheless equally as important and fruitful in their respective fields.

The aim of this paper is to analyze, from this perspective, the deeply "metabolic" relationship – the so-called Wahlverwandtschaften – between holistic geography Alexander von Humboldt's and Carl Ritter's and German Idealism. This analysis is based on the production of both geographers, from their Meisterwerke, to letters, correspondences, conversations, papers, fragments, notes, self-biographies etc.

Both, Humboldt and Ritter, built their ideas of geography founded on the knowledge of the Naturgeschichte, on the travelers' and explorers' chronicles/reports, from a permanent interaction with German Idealism thinkers (those linked with the Aufklärung as well as those representatives of the German Romanticism). Each one in his own way produced a kind of geography that the subsequent generation unfortunately had to deconstruct, but that we need to rescue today.

History of geographical Thought; Epistemology of Geography; Alexander von Humboldt and Carl Ritter; Holistic Geography; German Idealism

How international was The International Congress of International Geographical Union at 1956, in Rio de Janeiro?

Mariana Lamego, Universidade do Estado do Rio de Janeiro

In an increasingly way, scientific encounters are been taken as investigation phenomena by those engaged in histories of geography. Scientific encounters play a very important role in the knowledge circuit because they are center of knowledge communication, during their fleeting existence in time and space. The idea of science as a form of communication, supported by Secord in his paper

ICHST
2017

Knowledge in Transit (2007), suggests that there is no distinction between the making and the communicating of knowledge.

Scientific meetings are always a place of encounters, and the so-called international ones are also places of interaction between different cultures and between different interpretive communities. And it is during the act of communication that knowledge cease to be local, or property of a single or individual group and became part of the understanding of much wider groups of people.

The present paper intends to investigate The 18th International Congress of IGU held in Rio de Janeiro, at 1956, in order to address how international it was, considering the dissemination, translation and application of concepts, theories and methods among Brazilian and foreigners geographers. The 18th International Congress was the first and only international geographical congress of IGU held in Brazil. It was an unprecedented moment, regarded as a turning point in affirmation of Brazilian geography among the international geographical community.

In this paper, I seek to trace an anatomy of the congress, in order to show its political, social, scientific and geographical contexts embedded in the epistemic and cultural components of Brazilian and international geography. I emphasize the emergence, as well as the absence or banishment, of some geographical topics and subfields reflected in the dynamics of the session papers and commissions of IGU congress. Finally, some particular attention is given to speeches spoken during the congress. According to David Livingstone's main argument in *Science, site and speech: scientific knowledge and the spaces of rhetoric* (2017), it is possible to study and recognize how places enable and constrain what may be said and heard about particular scientific claims for universality. And, as I want to argue, since scientific encounter is clearly a rhetorical space, it is possible to understanding how it is crucial to the internationalization processes of geographical knowledge.

UGI congress, knowledge in transit, Brazilian geography

"Our Field is the World": Geographical Societies in International Comparison, 1821–1914

Maximilian Georg, Leibniz Institute for Regional Geography, Leipzig

Well before geography emerged as a professional science, Geographical Societies, of which the first was founded in Paris in 1821, made crucial contributions to the discipline. They organized and supported expeditions, published research results in their journals, and reached a wide public with their talks and exhibitions. Furthermore, in the second half of the 19th century, Geographical Societies sprang up like mushrooms in Europe, and also all other continents saw the foundation of some. By cooperating and exchanging literature with each other across the world, the Societies lent to geography from early on a truly international dimension. Notably, they organized the International Geographical Congresses from their premiere in 1871 (Antwerp) until their tenth edition in 1925 (Cairo), after which the newly established International Geographical Union (IGU) took charge of those gatherings.

In spite or because of their complex history and mutual entanglement, scholars have so far examined Geographical Societies mostly in the form of one-dimensional, merely descriptive memorials on the occasion of Societies' anniversaries. In early 2016, our research group on the history of geography at the Leibniz Institute for Regional Geography, headed by Prof. Ute Wardenga, has launched a different project: within the framework of Leipzig's Collaborative Research Centre (SFB) 1199 – "Processes of Spatialization under the Global Condition", we analyze the journals of some 40 Geographical Societies from around the world in the course of the "long" 19th century, until World War I, in order to learn how each of them conceived and produced space; by themselves, and in reaction to others. And unlike most previous research, we do not restrict ourselves to Societies of major capitals such as Paris, Berlin, or London, but we likewise consider the institutions of smaller cities and countries.

In my paper, I will outline the nature of Geographical Societies during the period indicated – what and where they are, how they came into being, how they differ within and across countries. Then, I will explain the standardized, computer-based procedure that we have developed to record, with a

team of researchers and assistants reading various languages, the Societies' heterogeneous journals. Finally, I will present preliminary results of our work, using a few Geographical Societies as examples, such as those of Brussels (founded 1876), Edinburgh (founded 1884), or Marseille (founded 1876).

Geographical Societies; History of Geography; Global History; 19th Century until World War I

Geography and the League of Nations International Committee on Intellectual Cooperation

Michael Heffernan, University of Nottingham

This presentation will review the debates about the potential role of geography in promoting the ideals of internationalism and the work during the 1920s and 1930s. The presentation will consider the attempts by leading internationalists to reformulate the discipline of geography after World War One, from a subject widely associated with national and imperial forms of citizenship into a new proselytising educational project dedicated to the ideals of internationalism, cultural understanding and pacifism. These efforts, part of a wider programme to promote internationalism in schools and universities across Europe and the wider world, were loosely co-ordinated by various national League of Nations organisations and educational charities, by the League of Nations International Committee on Intellectual Cooperation (ICIC), established in Geneva in 1922, and by the International Institute of Intellectual Cooperation (IIIC), established in Paris as an institutional focus for the ICIC in 1925. The presentation will draw on the unpublished archives of the ICIC in Geneva, the IIIC in Paris, and of Gilbert Murray and Alfred Zimmern, two prominent English classicists who were centrally involved with both the ICIC and the IIIC throughout the interwar years, in Oxford.

Internationalism, Geography, League of Nations

Ne pas franchir. La limite Nord/Sud comme outil de domination?

Pascal Clerc, Université Lyon 1

C'est sans doute sous la plume du diplomate britannique Oliver Francks, qu'en 1959 apparaît le couple «Nord/Sud» pour classer en deux catégories les pays du monde. Ce genre de classement binaire n'est pas nouveau mais il change quelque peu la perspective en mobilisant un vocabulaire apparemment plus neutre, mais apparemment seulement, que «pays riche» ou «pays sous-développé».

Mais c'est en 1980 que l'expression « Nord/Sud » est vraiment popularisée avec la publication d'un rapport pour l'Organisation des Nations-Unies rédigée par une commission dirigée par Willy Brandt (un homme du « Nord »). Plus précisément, la nouveauté de ce rapport est cartographique avec le tracé d'une limite qui divise le monde en deux: pays du « Nord » d'un côté, pays du « Sud » de l'autre.

La communication visera en premier lieu à rappeler brièvement cette histoire mais l'essentiel sera de tenter de comprendre en quoi ce vocabulaire et cette limite sur la carte participent:

- de la représentation d'un monde binaire «confortable» pour des interprétations un peu paresseuses de l'organisation globale; ce sera l'occasion de revenir à la fois sur les modèles binaires de pensée du monde (et leur puissance interprétative) et sur la question de l'altérité et de la construction d'un double négatif de soi
- d'une forme d'assignation à résidence des pays du «Sud» (qui sur un plan strictement terminologique seront toujours au sud); la limite ne se franchit pas et l'assimilation d'un groupe d'états à des situations cardinales la rend immuable et possiblement déterministe
- de la construction/consolidation d'un monde stable qui de toute évidence relève de l'illusion,

comme si en 36 ans les grands équilibres géoéconomiques de la planète n'avaient pas changé (ce que démentent toutes les approches, même statistiques).

Pour cela, la limite «Nord/Sud» sera analysé à travers différents types de discours et dans différentes sphères, en France principalement: la sphère scolaire (analyse d'ouvrages scolaires de géographie), la sphère médiatique (articles de presse), la sphère politique (propos d'hommes et de femmes politiques).

Limite Nord/Sud; Développement; Monde; Représentation

Coopération cartographique internationale et délimitation frontalière: la commission franco-espagnole Caro-Ornano aux défis du terrain (Pyrénées, 1784-1792)

Puyo Jean-Yves, Université de Pau

García-Álvarez Jacobo, Universidad Carlos III de Madrid

Il fallut attendre le traité des Pyrénées de 1659 pour que les Pyrénées fassent office de frontière entre les États espagnol et français. Toutefois, la question de sa matérialisation ne constitua pas une priorité pour les deux puissances voisines jusqu'à ce que se multiplient tout au long du XVIII^e siècle les conflits d'usage, parfois violents, entre les communautés locales frontalières. Devant l'échec rencontré par plusieurs opérations communes de délimitations partielles de ces limites étatiques, les deux États se résolurent à «sortir les grands moyens» afin de réaliser à l'échelle de l'ensemble de la chaîne pyrénéenne un levé topographique des confins frontaliers, destiné par la suite à servir de base au tracé d'une ligne de démarcation reconnue par les deux partis. La commission bipartite franco-espagnole Caro-Ornano (1784-1792), réunie dans ce but, constitue un épisode encore mal connu alors qu'il s'avère du plus grand intérêt, reposant sur une collaboration étroite entre diplomates, ingénieurs et militaires des deux parties. Si quelques recherches, anciennes comme récentes, espagnoles ou françaises, ont abordé son étude, le croisement des différents fonds archivistiques reste encore à réaliser. Ainsi par exemple, les documents relatifs à cet épisode, contenus au sein des Archives diplomatiques du ministère français des Affaires étrangères (La Courneuve), demeurent encore inédits. Leur consultation devrait permettre notamment d'apporter un éclairage nouveau sur le volet scientifique des travaux de cette commission. Ainsi, par exemple, quels ont été les arbitrages ayant abouti à la méthodologie adoptée en ce qui concerne les levés topographiques? Celle-ci s'avère en effet très novatrice pour l'époque, basée sur un quadrillage du terrain à lever et la constitution de 8 binômes composés chacun d'un ingénieur français et d'un ingénieur espagnol, placés «[...] à même hauteur à la droite et à la gauche de la ligne des limites, de manière qu'à la fin de la campagne il puisse résulter un ensemble sans interruption ni lacunes». Cette communication propose donc d'exposer et d'analyser les principaux critères, problèmes et réalisations de cette expérience de coopération bilatérale cartographique, si peu connue alors qu'elle s'avère ambitieuse et, à bien des égards, innovante dans ses objectifs.

cartographie - Pyrénées - Caro-Ornano - XVIII^e siècle

Personified Continents in Public Places: Art, Internationalism and Geography in Late Nineteenth Century Paris

Toshiyuki Shimazu, Wakayama University

This paper focuses on the unexplored relationship between art, internationalism and geography in late nineteenth century Paris. Special attention is paid to the installation of allegorical female statues

ICHST
2017

representing the continents of the world. Geography has long been seen as engaging in the task of representing the world as a whole since Ptolemy's *Geographia*. The represented world has always possessed the characteristics of imaginative geographies, the content of which has been elaborated mainly by the representing subject rather than the represented object. The medium through which the world is represented has been diverse, including texts and images, as well as maps. It should be noted here that material objects in space have also been functioning as such a medium. The practice of representing the continents in female form dates back at least to Abraham Ortelius's *Theatrum Orbis Terrarum* published in 1570, reflecting the ancient idea of mother earth. In these respects, two Paris cases are particularly worth noting. One is *Les Quatre Parties du Monde*, located at the south end of the Jardin des Grands Explorateurs. The other is a group of six separate statues symbolizing the six continents, now relocated onto the esplanade in front of the Musée d'Orsay. *Les Quatre Parties du Monde* was installed in 1874 at the north end of the Avenue de l'Observatoire, which was constructed itself along the Paris meridian. Its installation might have some connection with the suggestion for the utilization of the old Ferro meridian as the prime meridian made by the second international geographical congress in Paris in 1875. The Ferro meridian had been declared as the prime meridian by Louis XIII and Cardinal Richelieu in 1634. The Paris meridian had been believed to run 20 degrees east from the Ferro meridian and the congress's suggestion meant the priority of the Paris meridian over its Greenwich counterpart. Three years later, another six female statues were installed at the Palais du Trocadéro, which was one of the main venues for the Exposition Universelle of 1878. The universal exposition was itself a visible manifestation of internationalism emerging in late nineteenth century Europe. It is evident that the statue for Europe was figured in a more civilized style than the other five statues. In sum, these female statues epitomized the French aspiration for a form of internationalism in which Paris would be the center par excellence for such a rational movement.

history of geography; imaginative geographies; universal exposition; prime meridian; statue

Internationalisation and the Cold War: the development of Soviet geography since the late 1950s

Vladimir Kolosov, Institute of Geography, Russian Academy of Sciences

The author considers the development of Soviet geography since the late 1960s arguing that despite of a relative isolation, problematic and limited personal contacts and ideological restrictions it was strongly affected by internationalisation and followed general paradigms. The participation since 1956 of leading Soviet geographers in the activities of the International Geographical Union (IGU) played a particularly important role. The 23th IGU Congress hold in Moscow remained the largest in its history until 2012. Soviet geographers also participated in a number of international projects. They translated to Russian a significant number of books published abroad. Finally, they published one of the world best abstracts' journals which covered all fields of geography and gave an adequate idea about its progress abroad. Thanks to slow, gradual but continuous internationalisation Soviet geography had a considerable impact on some national geographical schools. In conclusion the author compares the influence of internationalisation on the development of Soviet and Russian geography nowadays.

internationalisation of science, geography, "he USSR

A map of asymmetric research design – Brazilian-German and Brazilian-French Geography in the 20th century

Wolf Dietrich Sahr, Universidade Federal do Paraná

By the end of the 20th century, international research cooperation is usually seen as a cooperative exchange process of ideas and activities within an international framework. However, specifically in the case of emerging economic powers like Brazil, these relations have been defined for a long time by asymmetric power geometries which can be mapped. This specific research investigates the differentiated network of personal and epistemological constellations comparing French and German initiatives for geographical research in Brazil, and the positioning of Brazilian counterparts. It hereby tries to deconstruct the myth of school-building (German School, French School) in Brazil venturing into the description of surging independent forces (or independence-seeking forces) among Brazilian Geographers. For this purpose, it analyses the unequal fields of research subjects/objects, the confrontation of European methodologies with Brazilian social life, the unequal availability of research infra-structure for both European and Brazilian researchers, and the question of personal relations in contrast to institutional conditions. Geographically, the analysis is focusing on a comparative study of a more center-oriented geographic network of USP geography, mostly linked to French geographers, while German geographers are mostly appearing in more de-centered networks with links to Rio de Janeiro and some semi-peripheral areas of Brazil (Rio Grande do Sul, Santa Catarina, Minas Gerais). It seems that the peripheral field of Amazon research is disputed by researchers from both countries together with Brazilian researchers, due to development interest in a phase of increasing globalization. Besides of specific Brazilian and European research interests, also the question of ethnicity and rural-urban relations appears to be important for understanding this context.

Geography Cooperation Brazil France Germany

007. Narratives of Future Earth

A geography in transformation: the modernizing interventions in the Brazilian semi-arid region at the beginning of the 20th century

Almir Leal de Oliveira, Universidade Federal do Ceará

The objective of the research is to discuss how the natural sciences planned interventions and altered the water reality of Northeast Brazil in the early twentieth century. Since the creation of the Inspection of Works Against Drought (1909), different areas of knowledge have been involved in the elaboration of a diagnosis of the dry region reality in order to guide modernizing interventions such as the construction of dams, irrigation projects, construction of communication routes and meteorological stations, among others. The science produced in the period sought to diagnose the geomorphological, botanical and social conditions of the sertão aiming at its transformation in the future. This study seeks to show this scientific production and demonstrate how it was the basis of the transformations of the semi-arid environment throughout the twentieth century.

Science, Modernization, Brazilian Northeast, Drought

"Crise hídrica" - activism, science, imagination, landscapes during the 2014-15 water crisis in São Paulo

Andre Sicchieri Bailão, Universidade de São Paulo

The city of São Paulo suffered a severe drought during 2014-15 — something that has been called 'water crisis' (crise hídrica) by local media: a crisis in water supply due to infrastructural and socio-natural factors. During the crisis a network of activists, social movements, NGOs was quickly formed around a series of social actions, public policy debate, and scientific narratives. These scientific narratives were both constituted, mobilized and circulated through public meetings, classes and seminars, demonstrations, debates with State institutions and the civil society, film festivals, social experiments — and even the creation of different urban maps, walks and landscape change projects. As an anthropologist who had recently finished a research project on climate change science, I was drawn to and followed these public events, trying to understand the circulation, creation, and recreation of scientific narratives between scientists and civil society activists. Narratives concerning socio-natural crisis, catastrophes and environmental change expose different explanations, environmental, infrastructural and social factors. As in any politically charged debate there are mixtures and clashes between competing narratives and alliances.

In this sense, this paper aims at identifying and describing those mixtures and clashes of explanations, anxieties, and imaginations — filled with scientific imagery; and also creative local solutions and explorations during the water crisis in São Paulo. The goal is to present how scientists and social activists produced them, the translations and conflicts that arose, and how landscapes and nature-societies are imagined and constituted. 'Water' is one of the main topics in future environmental change debates, and São Paulo has become one of the main examples (and experiments) of how the future is being imagined and lived.

water crisis; sociotechnical controversy; climate disasters; social movements

International training on climate change considering different culture background

Bangzhong Wang, China Meteorological Administration Training Centre

Climate change involves so many aspects and has very long-term impact. The training is very important for scientific understanding on the complexity of climate change. China Meteorological Administration Training Centre (CMATC) promotes international training on climate change by the support of China government in recent years. The officials and scholars who came from different cultural background discussed and shared the information related to climate change policy and knowledge in class. The participants from different countries in Asia and Africa learned from Chinese action and response measure on climate change. At the same time, these trainees introduced the practice and experience of their countries. Much differences and diverse understanding about the governance of climate change as well as environment protection and disaster risk management were shown from these communications based on different cultural backgrounds, which provide a wealth of inter-culture understanding for climate change and Future Earth.

Climate change; CMATC ;training culture background; participants

Blurring frames: changing narratives and practices triggered by the provision of climate services in south South America (SSA)

Cecilia Hidalgo, Universidad de Buenos Aires

The gradual inclusion of issues related to adaptation to climate change and mitigation of their effects on the political national agendas and as main components of regional agendas has created exciting opportunities for national and regional collaboration. In SSA the aim to provide climate services has demonstrated the need for innovation at institutional levels, being salient the establishment of a Regional Climate Center (RCC-SSA) in 2012 where a broad disciplinary spectrum of scientists, practitioners and stakeholders is trying to work effectively at the interface between research and decisions. Because climate services depend critically on diagnostics of recent conditions and predictions/projections of regional climate, climate scientists' framing of the issues constitutes not just an important research focus but a dominant discursive and representational proposal. Nevertheless, as the information produced by RCCs is aimed at assisting decision making in climate-sensitive sectors (e.g., agriculture, water resources, human health), it is common sense to recognize that progress in climate knowledge must be matched by a commensurate understanding of how natural and social sciences can inform and support climate-resilient decisions and policy. New and many times contested framings and narratives enter into play in those emerging innovative partnerships with a range of academic, governmental research and resource-management institutions, and non-governmental organizations from multiple sectors of society called to enhance the capabilities of operational climate agencies and to coproduce climate knowledge. In this paper the experience and multiple narratives now cohabiting in the institutions involved in the provision of climate services in Argentina, Brazil and Paraguay -countries actively involved in the establishment of the RCC-SSA- are presented on the basis of ethnographic research. We first focus on regional-level opportunities that have encouraged interaction and collaboration. We then identify main regional-level risks and difficulties in relation to the plans to promote a deeper sectoral involvement. We show how the main proponents of innovation – scientists, politicians, administrators, stakeholders and entrepreneurs – alternatively draw and blur in discourse and practice the boundaries of their territories in order both not to lose centrality and to ensure their own credibility and expansion.

climate services; Regional Climate Center (RCC-SSA); contested framings; innovative institutional partnerships; decision making in climate-sensitive sectors

Urban climate in History: fifty years of meteorological observations in Rio de Janeiro during the 19th century

Christina Helena Barboza, Museu de Astronomia e Ciências Afins

Although a recent UN report stated that 54% of the global population live in the cities, where the emission of the main greenhouse gas, carbon dioxide, tends to be higher, scientific knowledge on climate change has been concerned more with large scale than with micro-scale data and models. This paper aims to contribute to the growing field of urban climatology with an historical approach. Luke Howard's study on the climate of London is considered a pioneer and isolated landmark in urban climatology. However, in 1892 the director of the Brazilian National Observatory, Luiz Cruls, published a book with an analysis of the climate of Rio de Janeiro based on almost 50 years of regular observations of weather elements, such as temperature and rainfall. This paper intends to examine some concepts and practices adopted in the collection and analysis of these meteorological observations, as well as the socio-political and cultural context in which the book, titled "The Climate of Rio de Janeiro", was produced and published.

Urban climate; Urban heat island; urbanization; modernization

Rescaling climate: How climate research changed conceptions of climate

Dania Achermann, Aarhus University
Matthias Heymann, Aarhus University

Since the 1950s, the way climate has been investigated changed significantly. Most climatologists in the 19th century adhered to a Humboldtian conception of climate as a timeless, geographical concept associated with a constant set of atmospheric characteristics that were connected to specific places on the surface of the earth. Climatology was mostly understood as being a geographical discipline with a strong interest in the interaction of climate with human beings. Interest in the small scale and attention to geographical detail was a hallmark of climatology. With the emergence of a physical understanding of atmospheric processes in dynamic meteorology and the development of computer-based numerical simulation of weather and climate since the 1950s, scientists developed a remarkably different understanding of climate: climate was portrayed as a complex, inter-connected global phenomenon that is subject to change within human timescales. Research strategies such as climate modelling and paleoclimatological research provided new data on very large temporal and spatial scales. In contrast, traditionally strong interests in the local and human dimensions of climate declined. As a consequence, climate interest and knowledge became increasingly detached from local climate knowledge and did not easily translate into political action on the regional levels, as social scientists have critically observed. In this paper we will investigate historical processes that stood behind a globalization of climate knowledge and a loss of the smaller and the human scales by exploring the role of two major research domains in the globalizing of climate knowledge: climate modelling and ice core paleoclimatology.

History; Climatology; Climate Models; Scales; Paleoclimatology

A strong sense of time: museums and climate change engagement

Henry McGhie, Manchester Museum, University of Manchester
Sarah Mander, Tyndall Centre, University of Manchester

The challenge of climate change crosses disciplines and there are widespread calls for greater public engagement and action on the issue. This presentation will explore how museums, as civic institutions, can support education and action around the challenge of climate change. Museums, more specifically their collections, are often associated with the past, and the overtopping of time. This presentation explores how museums can reposition themselves to actively promote civic participation and action around climate change, focusing as much on the present and the future as the past. The presentation draws upon recent experiences at Manchester Museum, part of the University of Manchester (UK), which worked in partnership with Tyndall Manchester and Manchester Climate Change Agency on a range of engagement activities promoting climate change adaptation and mitigation, as part of Manchester's time as European City of Science (2015–16). These activities drew upon various perspectives relating to time and place, drawing on the museum's global collections spanning millions of years of history and its position within the world's first industrial city. The triangulation of academia, public engagement and public policy raised challenges of working together, but was aimed at maximizing public service and promoting civic participation among the public, drawing upon the past and creating public opportunities directed towards shaping the future. More generally, this presentation will explore how a range of time-related concepts can be applied or repurposed to museums concerned with climate change engagement, including Foucault's work on heterotopias, the 'big here and the long now', the work of John Schaar and the History

Manifesto. The presentation will explore the role of the museum as an agent of change, through its relationship with audiences and the agency that they are given within museums as civic spaces.

climate change, museums, public engagement, activist practice

Sedimentary systems in the Anthropocene: Geomorphic change and Earth system feedbacks

Jasper Knight, University of the Witwatersrand

Sedimentary systems refer to the transfer of materials in solid and dissolved forms within and between different locations on the Earth's surface, along structured pathways (network systems), that can result in net loss of sediment volume in one place and accumulation elsewhere. The workings of sedimentary systems can therefore be measured – commonly over scales that are relevant to environmental management – through changes in sedimentary fluxes (materials in transport) and geomorphic change on the land surface by landform erosion/deposition. However, these systems are sensitive to disturbance by human activity, most obviously by geoengineering of river (dams, channelization) or coastal environments (sea walls, groynes, reclamation). Ongoing climate change (global warming) is exerting a major control on the dynamics and functionality of present-day global sedimentary systems of mountains, rivers and coasts in particular. Changes in climatic forcing, in combination with ongoing pressure on the land surface by human activity, are resulting in a reorganization of sedimentary systems and processes, on a global scale and affecting all sedimentary systems.

This paper examines the physical basis for observed and projected changes in sedimentary systems, with particular reference to mountains, rivers and coasts. Based on our understanding of sediment systems and processes from the geological past, an estimate of geomorphological sensitivity to future climate forcing can be established. This can help identify boundary conditions that can help constrain the future behaviour of sedimentary systems in climatically-sensitive depositional settings. The implications of ongoing climate change for the future dynamics of sedimentary systems are discussed, in the context of geomorphic (landscape) change and Earth system feedbacks. These feedbacks are vital for environmental sustainability in the Anthropocene, including agriculture and food production, near-surface and mountain aquifers and water supply, geohazards, biogeochemical processes including C sequestration and export, and biodiversity. The present lack of interconnections between the scientific study, monitoring and management of these diverse environmental components is of concern with respect to correctly identifying environmental 'tipping points' in the Anthropocene world.

Anthropocene; Sediment systems; Landscape change; Geomorphology

The politics and infrastructures of atmospheric sciences in Brazil

Jean Carlos Hochsprung Miguel, Federal University of São Paulo

This paper investigates the practice of climate modeling in the Brazilian National Institute for Space Research (INPE) to understand how climate models become central tools in meteorological research and climate policies. Through the perspective of Science and Technology Studies (STS), the paper investigates how climate models are socially constructed and how they become authoritative through extensive heterogeneous networks that enable them to have scientific and political importance. Methodologically, the modeling practices were analyzed through ethnography, interviews, participation in scientific events and document analysis. The fieldwork was conducted

between 2013 and 2016, during which visits were made to INPE's Center for Weather Forecasting and Climate Studies (CPTEC). Based on the information obtained in the fieldwork, the paper analyzes how modeling practices at INPE are constructed as part of a globally distributed climate knowledge infrastructure. We researched how climate infrastructures were constructed in the Brazilian context and in what way these conditions constitute modeling as a set of politically valued socio-technical relations. Such modeling practices were studied at INPE with a focus on global atmospheric modeling and earth system modeling, trying to assess how these practices were implemented in Brazil and how they are associated with a policy to foster the national climate sciences. The paper concludes that in developing Brazilian climate models, the actors involved with climate science sought to modernize national research infrastructures and connect them to global scientific networks involved in modeling and climate research. This updating of research infrastructures in the field of atmospheric sciences in Brazil is associated with a dispute around the epistemic and political authority of meteorological and climatic knowledge at different scales of the governance of climate, in which different conditions of techno-scientific development are relevant. In these disputes, the actors are considered global or national according to standards of scientific production established by central countries; among them, the current epistemic supremacy of climate modeling makes models a privileged focus in international and national scientific networks in the climate area.

Climate modeling; STS; Climate policy; North-South Science networks

Brazil in the History of the Anthropocene

José Augusto Pádua, Federal University of Rio de Janeiro

The paper tries to rethink Brazilian history in the context of what was called the three stages of the Anthropocene: 1) the building of urban-industrial civilization powered by fossil fuels, 2) the great acceleration after the 1950s and 3) the self-conscious Anthropocene in the beginning of the 21st century, i.e., the growing debate about the need for a global transition to a sustainable future. Brazilian presence in the historical making of the Anthropocene is investigated according to three types of links: a) the Brazilian economy as a supplier of natural resources to the global changes that shaped the Anthropocene; b) the participation of Brazilian society in the distinctive production and consumption patterns related to the Anthropocene, and c) the potential participation of Brazilian society and intelligentsia in the creation of cultural frameworks for a self-conscious Anthropocene. The paper argues that Brazil's presence during the first stage was relatively modest, both as a supplier of natural resources and as a relevant player in the industrial world. After the 1950s, however, the country faced a rapid and intense process of population growth, industrialization and urbanization, simultaneous to the opening of new agricultural and mining frontiers in the savannas and tropical forests of the Western and Northern parts of its huge territory. In the context of the Great Acceleration, it is becoming one of the main players at the crossroads of the Anthropocene. As the biggest national territory in the tropical world, with abundant albeit regionally unequal reserves of freshwater, biodiversity, and fertile soils, not to mention its vibrant and creative society, Brazil can become a major player in the building of social strategies grounded on clean and renewable sources of energy. But this potential role depends on uncertain political disputes over the development model to be adopted in the near future.

Brazil; Anthropocene; Tropical World

Values and Preferences in Adaptation Planning: insights from the Metropole Project

Luci Hidalgo Nunes, Institute of Geosciences / UNICAMP

Roberto Greco, Institute of Geosciences/UNICAMP

Adaptation concerns to the adjustment of how human beings design and manage the environment, being currently, also related to the understanding of how global environmental changes might evolve in the future and to the recognition of which approaches, methods and tools may help to cope with the social, economic and political transformations. And because adaptation is heavily dependent on social, cultural and political contexts, it is more related to the local scale.

In this perspective, the project Metropole- an international consortium involving Brazil, the UK and the US (Belmont Forum, Coastal Vulnerability Call) was focused on identifying factors that make a shift in knowledge, attitudes, values and decision making about local climate risks and adaptation strategies in three coastal sites.

In each community, two stakeholder engagement workshops occurred apart two months, which permitted to evaluate adaptation attitudes of the community participants by means of comparisons of the responses of conduct surveys at beginning of Workshop One and after Workshop Two. In the first meeting the impacts of SLR and storm surges were presented by interactive computer-based scenario simulations generated by the platform CoAST (Coastal Adaptation to Sea Level Rise Tool), which showed expected damages to assets at various timeframes if no-action is taken. Participants chose two adaptation measures and for the second meeting, the CoAST software tool run again, using these two actions, showing how much building damage may be avoided (or not) over time, if such strategies are implemented.

The questions of the surveys evaluated aspects such individual and community experience with coastal hazards, preferences for several potential adaptation actions and for existing and possible public finance mechanisms for adaptation and perceptions about barriers to implementation. Responses were also evaluated according to some personal characteristics (age, gender, educational level, political preferences). Some of the results highlights are: most of participants were more favourable to support adaptation measures after final workshop; there was a remarkable change of opinion concerned to the possibility that 'my' property can be affected and that climate change is a distant issue. New taxes were the least acceptable adaptation option and it was clear that giving citizens better information is positive if people can participate of the process.

Adaptation, environmental changes

Science and policies of deforestation in the Amazon: reflecting ethnographically on multidisciplinary collaboration

Marko Monteiro, UNICAMP

This chapter discusses results from an ethnography of a multidisciplinary and collaborative scientific project focused on the Amazon. I argue that ethnographic engagement with scientific projects can help illuminate some of the challenges of doing complex, large scale environmental research. In the case analyzed here, the collaboration involves multidisciplinary work between computer modeling, social sciences and environmental sciences, as well as an interface with policy. Such a wide array of cooperation brings unexpected complexity to the process of arriving at usable results by bringing to dialogue disparate actors and disciplinary fields. The project analyzed, by partially internalizing the interface with local stakeholders and public policy, made it more difficult to close internal controversies about scientific results, and these dynamics are analyzed. The ethnography shows, in conclusion, that arriving at usable scientific results through cooperative interdisciplinary work can be a greater challenge than is perceived by scientists engaged in such exercises, as such sharing is conditioned by

processes involving misunderstandings between disciplinary boundaries and epistemic cultures. Such challenges also apply to the interface with local and policy stakeholders, which helps illuminate some of the challenges in making science more open to engagement with society.

Ethnography; anthropology of science and technology; science-policy interface; environmental infrastructures; STS

The source of Co-Ching Chu's thought on climate change

Mengmeng Sun, School of history and culture of science, Shanghai Jiao Tong University, P. R. China
Xiaoyuan Jiang, School of history and culture of science, Shanghai Jiao Tong

The paper "A Preliminary Study on the Climatic Fluctuations During the Last 5,000 Years in China" by Chinese geographer Co-Ching Chu, was once the weapon for refuting the prevalent view of "world climatic anomaly" and the "new ice age". And nowadays it even becomes a basis for questioning the theory of "man-made global warming". In order to find out the source of Co-Ching Chu's thought on climate change, this paper analyzes The Diary of Co-Ching Chu, and finds that he is mainly influenced by the mainstream view on the Conference of "climate change" in Rome (1961) hosted by UNESCO and WMO, and is enlightened by H. H. Lamb in some key point. It cannot be excluded that Co-Ching Chu's attitude to the abrupt climate change is influenced by the ideology of the "Great Culture Revolution".

climate change; climatic anomaly; Co-Ching Chu; Great Culture Revolution

Disputes, conflicts and advances along the Brazilian numerical weather forecasting trajectory

Paulo Augusto Sobral Escada, Instituto Nacional de Pesquisas Espaciais

During the 80s, National Institute for Space Research (INPE) researchers and scientific leaders from Meteorology area aimed to legitimize the idea of establishing a numerical weather forecasting center in Brazil. Forecast modernization need was the main argument of these scientists which received support from certain sectors of society, National Congress and government itself. Episodes of conflict among research groups from different meteorological institutions were present at this phase and reverberated in the national media, which brought visibility to INPE's scientists claim. The Center for Weather Forecasting and Climate Studies (CPTEC / INPE) was established in the early 90s, but budgetary difficulties and infrastructure improvement and update needs brought back the rhetoric of forecast modernization. CPTEC/INPE could advance implementing Global and Regional Models but again under some inter-institutional conflicts. In the 2000s, issues about climate change and meteorological extreme events gained space within the government agenda and encouraged the creation of new institutions within this large disciplinary area. New conflicts among research groups and institutions have surfaced. A good part of these conflicts comes down to the dispute around scarce government resources. Meteorology, Hidrology and Climate policy formulation process is non-existent or fragile and could be confused with disputes and competitiveness among leaders and scientific groups. According to the policy analysis perspective, when polity (institutional framework and rules of the game) is well defined and stable, conflicts among actors tend to decrease, reflecting less heated politics and actions that favor negotiations and agreements, thus producing policies of broader and more stable consensus in the long run. But, in the Brazilian case, this chain of ideas is inverted. In other words, non-existent or ineffective polity impacts the politics environment, which in policy conformation tends to generate instabilities in medium and long terms. This statement is

based on documentary research and interviews carried out in recent years with scientists involved in creating and implementing CPTEC processes. Science has been advancing, however, under conflicts and unilateral decision processes. From a methodological point of view, how could Social Studies of Science, which have an interest in understanding the relationship between science and democracy, contribute to such a study?

history of meteorology; science and democracy; policy analysis; social studies of science

Binding Past, Present and Future Earths: Making Paleoclimatology Matters

Tiago Ribeiro Duarte, University of Brasília

Martin Skrydstrup, University of Copenhagen

Meritxell Ramírez-Ollé, University of Keele

Paleoclimatology is an amalgam of disciplines that reconstructs past climates by using a number of archives, such as ice cores, tree rings, marine sediments, outcrops, corals, etc. By doing so, paleoclimatologists seek to contribute to the study of the history of the Earth System, its main mechanisms of change, and to characterise its different time periods. With the emergence and growing importance of global warming as a scientific and political issue in the past few decades, paleoclimatologists have also turned their attention to this phenomenon. They have begun to target past climatic phenomena that can potentially shed light on current climate change and on the impacts of a rapid warming process on the environment and on human societies. In other words, paleoclimatologists have been focusing on constructing future Earths through the study of the past. In this paper, we aim to describe how paleoclimatologists bind past, present, and future Earths together by using a range of archives, proxies and techniques. We do so by comparing the results of three research projects on paleoclimatical research: an interview-based study of paleoceanographers, a short-term ethnography of an ice-core camp, and a long-term ethnography of a dendrochronology lab. We argue that paleoclimatologists' choice of research topic might be strategically connected to present and future climate change agendas, which makes their work politically relevant. But where does this community draw the line between relevant science and political agendas and how do they view the public life of the data that their sciences produce? Ultimately, how does this community envision "societal impact" of their science and the interfaces between the field, their labs and contemporary climate policy?

Paleoclimatology; Future Earths; Time Binding; Politically-Relevant Science

Historical research about meteorological hazards on drought and flood

Zhenghong Chen, China Meteorological Administration Training Centre

Guifang Yang, China University of Geosciences, Beijing

This proposal focuses on historical study about meteorological hazards and associated natural-anthropogenic variations in China, with specific attention given to the meteorological drought hazards and flood. The aim of this contribution would be to provide a comprehensive overview of meteorological droughts in North China, also flood in big city, with climatic change and anthropogenic factors. Our study highlights the region-wide meteorological droughts with a rather clear recurrence of 30 and 100 years. At the meanwhile, most Chinese metropolitan regions have experienced rapid urbanization. The meteorological hazards expose greater numbers of developed areas a variety of inhabitants to increased risk.

This paper attempts to characterize how urbanization process, as well as monsoon climatic oscillations, affects Shanghai's vulnerability to severe weather conditions. To assess how regional urbanization may impact vulnerability to floods. Our results indicated that the centennial scale metrological floods were a function of monsoon climate, while the decadal metrological oscillations in recent one and half centuries were primarily modified by the anthropogenic behaviors and resulting hydrologic characteristics. In view of the wide distribution, the meteorological droughts and floods are key issues for long-term social-economic harmonization in China. This study can assist in prioritizing disaster mitigation measures and ensuring regional sustainable development in the study area by historical methodology .

historical study; meteorological hazards; urbanization; climatic oscillations

009. Re-centering modern chemistry since the 1960s

Synthesizing a history of synthetic biology: the case of the UK, 1980-2017

Dominic Joseph Berry, University of Edinburgh

What role has the capacity for automated DNA synthesis played in the history of biology? Looking at the transition from 'gene machines' in the 1980s to contemporary 'gene foundries', this paper charts a history of synthetic biology, looking in particular at its influence and significance in the plant sciences, which have been otherwise neglected by historians of molecular biology. Working in the contemporary world requires a mixture of methods, ranging from laboratory observation, to interviews, experimental workshops, and archival research. As such this paper also draws together insights and observations from both the history and philosophy of science and science and technology studies.

One particularly significant feature of my historiographical focus on DNA synthesis is that I take seriously the recent claims of synthetic biologists to be 'engineering' biology. Whereas a number of historians of science have already pushed back the history of biological engineering to the nineteenth century or earlier, often with a particular emphasis on the work of Jacques Loeb, I take the opportunity to consider what might be novel about contemporary biological engineering. This historiographical decision provokes an exploration of the social, historical and epistemological features of engineering, pursuing the possibility that it is a distinct species of technical and scientific practice. At its most general then the paper confronts the issue of whether an engineered biology signals the success of biology as an independent and significant discipline over and above chemistry and physics, or whether biological engineers are intruding into the biological in a way that actually undermines these successes, returning biology to a lower status. If the twentieth century was the century of the gene, what happens to genes as they become the substrate of engineering?

Synthetic biology; plant science; molecular biology; engineering

Chemistry and the Life Sciences: Interdisciplinary Re-centering since the 1960s

Jeffrey A. Johnson, Villanova University

Despite the fundamental changes in the discipline resulting from the rise of quantum chemistry on the side of physics, and molecular biology on the side of biology, it could be argued that during the 1960s chemistry as a discipline still remained essentially what it had been a generation earlier, during the interwar period, or even at the beginning of the 20th century. As represented in educational curricula and typical textbooks, chemistry still comprised a few basic sub-disciplines (analytic, inorganic, organic,

biochemistry, and physical chemistry). This paper will address one aspect of disciplinary re-centering in chemistry since the 1960s: the impact of the evolving relationship of chemistry to the life sciences, looking particularly at the role of chemistry and chemists (or chemical engineers) in the further development of molecular biology, and the emergence of a series of new interdisciplinary disciplines between chemistry and biology including genetic engineering, metabolic engineering, structural biology, and synthetic biology. One of the characteristics of these fields has been the disappearance of “chemistry” or “chemical” from their names, despite the continuing fundamental significance of chemical knowledge and methods for their development. This may mislead some historians of science and technology, as well as the general public, into the belief that chemistry as a discipline has declined in significance for the life sciences, whereas if anything it has increased during the past half-century, as new methodologies have made it possible to use precise visualization and dynamic approaches in the structural analysis of biological molecules. This paper will address some of the resulting methodological and historiographical issues raised for historians of modern chemistry as a discipline. Incorporating notions of discipline-building and boundary-work, the paper will also examine some of the ways in which disciplinary organizations such as IUPAC, ACS, and EuCheMS have responded to the changing disciplinary landscape.

chemistry; life sciences; boundary-work; discipline-building; interdisciplinary fields

Challenging Chemical Chaos during the Cold War: The Case of the Belousov-Zhabotinsky Reaction

Konstantin S. Kiprijanov, University of Leeds

In 1950, the Soviet scientist Boris P. Belousov discovered an enigmatic chemical reaction with a very unusual periodic behaviour. The reactions was further investigated by Anatoly M. Zhabotinsky and his research group in the 1960s. In the 1970s, the “Belousov-Zhabotinsky reaction” (BZ reaction) came to the wider attention of scientists on both sides of the Iron Curtain, and the reaction’s mechanism and kinetic properties were gradually uncovered and explained. The BZ reaction has made an important contribution to the consolidation of Ilya Prigogine’s theory of non-equilibrium thermodynamics and paved the way for further investigations of self-organising systems in biology during the 1970s. Yet the reaction’s history is still poorly understood.

Focusing on the period between 1950 and 1975 and drawing on original research in English and Russian, my paper demonstrates how the BZ reaction served as a model for the study of complex nonlinear behaviour under relatively simple conditions in the laboratory and thus prompted a deeper theoretical understanding of nonlinear processes in physical and biological systems. In addition, I argue that by generating strong international interest in chemical and biochemical oscillators, the BZ reaction has contributed to an ongoing exchange of scientific knowledge across the Iron Curtain.

Chemistry; Nonlinear Science; Soviet Union; Cold War; International Research

Re-centering or decline? The last days of pine resin research laboratories in France and in the United States (1961-1973)

Marcin Krasnodebski, University of Bordeaux

Pine resin chemistry flourished in the United States and in France from the beginning of the 20th century. Generously funded by the local resin industry and by the government, the Pine Institute in Bordeaux and the Naval Stores Research Station in Olustee, FL shaped for years the boundaries of this practically-oriented discipline. The shrinking resin production did not affect the constantly

ICHST
2017

growing funding of both organisms after World War 2. At the beginning of the 1960s their situation was better than ever with the budgets rocketing sky-high. And yet, the Pine Institute and the Olustee Station faced a severe crisis in the following decade. The Pine Institute was on the verge of closure in 1969 and had to almost abandon resin research to survive. The Olustee Station was closed in 1972. What brought to an end two successful scientific organisms in such a short time? First, the industry relocated to cheaper wage economies; from France to Spain and to Portugal, and from the United States to Mexico, and then to China. Traditional pine resin industry consortia were either dismantled or marginalized over this period. Second, with the advent of more and more sophisticated analytical tools, the question appeared whether speaking of “resin chemistry” makes still sense. Resins are complex substances made of terpenes and resinic acids which can be later transformed into new synthetic compounds. Resin chemistry as a discipline built around a natural physical object started dissolving into multiple neighboring disciplines dealing directly with compounds or with finished products. At first, it might seem that this double re-centering was a healthy and economically reasonable phenomenon, the industry moved south and resin chemistry was replaced by more advanced disciplines. And yet, with the reconstruction of the Pine Institute and especially with the disappearance of the Olustee laboratory, a considerable amount of tacit knowledge was lost. Their chemists, often acting as “mediators” between forest and laboratory, possessed a set of skills that was not appropriated neither by the new generation of chemists disinterested in crude substances nor by the researchers from developing countries whose links with the new industry were rudimentary. This brings us to the question about the impact of “re-centering” on knowledge production patterns, as well as on its negative effects on scientific infrastructure in old research centers.

Resin; Naval Stores Research Station; Pine Institute

Changes in modern chemistry

Pierre Laszlo, Ecole polytechnique and University of Liège

Can one argue that the 1960s saw a Second Revolution in chemistry, with exploration of the entire periodic table, recourse to the entire scale of time, down to pico- and femtoseconds, and entire scale of space, down to nano- and picometers? I shall draw upon my experience as a research chemist, totalling several decades, to flesh out tentative answers to this question. This paper is thus retrospective, with the added feature of a personal memoir. In addition to my first-hand observations, I hold a belief in the complexity of history.

I hold it as axiomatic that historical phenomena do not depend for their occurrence upon single factors. Accordingly, questions from historians do not admit of simple answers — especially not reductionist answers. Historical interpretations by necessity are multiples, or they remain unoperative. It is not enough to identify and chronicle historical changes, it is at least as important to identify determinants of change. Such historical interpretations are not matters of individual opinion, where one historian's is as valid as another's.

Opposite viewpoints are the elitist and the populist. Scientists tend to the former, focussing on leaders guiding a crowd of followers. Historians, no doubt swayed by sociologists, tend to the latter: practitioners of a discipline, chemistry say, are acted upon rather than being actors of history. They are impelled by impersonal forces stemming from their tools and objects of study, not to mention the Zeitgeist, the historical context.

Moreover, changes have to be gauged against their converse, invariants. What has remained permanent about the actual practice of chemistry? And over what length of time?

The entire field, of both academic and industrial chemistries, was then a battleground between baconian rationalists, intent upon improved understanding of phenomena, and edisonian pragmatists, nurtured on trial-and-error. Catalysis, for a very long time, nearly until the end of the twentieth century, remained the province of the occultists. Its specialists viewed it as a dark art, which only a few initiates could fathom.

Considering the long haul and seeing chemists as the inheritors of alchemists, the wet way of the latter was and still remains very much with us — together with the containers in the laboratory, the glassware, and the solvents. This material culture is centuries-old, as archeologists will confirm, after they excavate twentieth-century labs.

change, invariants, culture, revolution

Giuseppe Cilento and the establishment of a new field of chemical studies: photobiochemistry without light

Andrea Paula dos Santos Oliveira Kamensky, Universidade Federal do ABC

Suzana Lopes Salgado Ribeiro, Universidade de Taubaté

Andreia Medolago de Medeiros, PUC-SP

Giuseppe Cilento (1923 – 1994), professor at Institute of Chemistry, University of São Paulo, Brazil, trained a full generation of chemists who like him devoted themselves to biochemical studies.

Cilento's work led to the development of a new field of research resulting from the association of other disciplines, like biochemistry and photochemistry.

Within this context, he investigated the participation of the triplet state in cell natural phenomena, as well as in deleterious processes like mutagenesis. Cilento further hypothesized that species excited to the doublet/triplet state could form in biological systems providing them the energy needed for the generation of activated oxygen and free radicals.

Along his career, Cilento published about 150 papers in Brazilian and international journals. He was globally acknowledged for his identification of chemical substances and molecules in biological systems that undergo changes in their physical characteristics under the effect of radiation. His work did not only influence the students he supervised, but also investigators from laboratories in Brazil and abroad, who collaborated with Cilento in the development of technologies to improve scientific knowledge. Cilento's personal files survived and are currently deposited at CESIMA, PUC-SP; documents that record his professional trajectory include letters, reviews and research reports, among others. Using these documents and interviews conducted with Cilento's coworkers according to the principles and methods of oral history, we are attempting to retrace the path that led to the institutionalization of a new field of studies, i.e., photobiochemistry without light.

Photochemistry; Chemistry; Oral History; Personal Files

010. The Human Ocean: Producing Knowledge in and on the Oceans

A drift across the Pole – How Petermann's concept of the Arctic influenced the German exploration of Antarctica

Cornelia Lüdecke, University of Hamburg

In 1865, August Petermann presented a new concept of the Arctic; it was based on two assumptions. The first hypothesis was that the unknown, northern part of Greenland stretches like an "elephant's trunk" across the Arctic up to Wrangel Island. The second idea was the existence of a warm ocean current connecting the Gulf Stream with the polynya west of Wrangel Island, a current that prevented the formation of ice east of Greenland, and this would enable ships to sail to the North Pole without any hindrance. The concept of Antarctica on the other hand was vague owing to only few land sightings, but prevailing wind directions indicated that the greater part of Antarctica would be in the eastern

hemisphere. However, nobody knew, whether Antarctica was a big continent covered by ice or a gigantic atoll with islands lined up along the southern polar circle. At that time maps typically had indications like “Southern Ice Ocean” or “Supposed Outline of Continent”.

Georg von Neumayer, a longtime promoter of a German south polar expedition, developed the expeditions route to sail south in 1872 following a warm ocean current in the Indian Ocean directing to Antarctica south east of Kerguelen.

According to the first model of the five climate zones of the earth, in which Parmenides introduced “Ant-arctica” in opposition to “Arctica” as to avoid a disequilibrium of the globe, the German Oceanographer Otto Krümmel extended Neumayer’s idea according to Petermann’s map of the Arctic. Krümmel connected all land sightings in the eastern hemisphere of Antarctica between 90 ° and 180 °E with the Antarctic Peninsula, resulting in an elephant’s trunk as well. The remaining land sightings became islands. Finally Krümmel connected Neumayer’s ocean current from the southern Indian Ocean with the Weddell Sea via the South Pole.

In consequence the German expedition ship and the equipment was especially designed to match a possible drift to the South Pole similar to the drift of Nansen’s Fram in the Arctic Ocean. In my paper I examine the transfer of Petermann’s concept of the Arctic to Antarctica and its effects on the outcome of the first German South Polar Expedition 1901-1903.

Petermann, ocean current, Antarctica, German South Polar Expedition 1901-1903

Homo aquaticus and Evolving Knowledge of the Ocean

Helen Rozwadowski, University of Connecticut

Knowledge of the ocean has derived from humans’ physical experience on, in and alongside it. While technology mediates much, perhaps most, knowledge of the ocean, the role of human bodies in the creation of knowledge about the ocean is equally integral. This paper notes the shifting involvement of human bodies in creating knowledge about the undersea environment beginning in 1949, when scuba technology became commercially available. Those involved with diving portrayed it as transformative, an experience conceived to be closely tied to human evolution. Jacques Cousteau declared in 1962 the emerging evolution of Homo aquaticus, a new species of human. This evolutionary thread of the underwater experience closely allied to the era’s ambitions in space; the best start for the successful journey to space was widely understood to be the ocean’s depths, while the uniqueness of the underwater experience was often compared to the weightlessness of space. Conscious embrace of evolution as an element of the human relationship with the ocean attenuated after the 1960s, perhaps a result of the failure of humanity to colonize the sea floor. Throughout this formative period for undersea exploration, evolution – as a biological and social concept and metaphor – colored the experiences of those who attempted to know the ocean.

oceanography; Jacques Cousteau; Homo aquaticus; diving; undersea exploration

Whose Science is it Anyway? The Woods Hole Oceanographic Institution Palace Revolt, 1954-1962

Naomi Oreskes, Harvard University

In the late 1950s, a dispute broke out at the Woods Hole Oceanographic Institution (WHOI) in the United States over the issue of U.S. Navy funding of scientific research. Before World War II WHOI was a small and poorly-funded institution. During the war, the U.S. Navy began to fund studies

related to anti-submarine warfare, funding that after the war grew into generous support for a broad range of investigations under the rubric of “military defense oceanography.” Initially, most WHOI scientists were thrilled to have this new, abundant source of funding for their research. However, by the mid 1950s, some were becoming concerned over a perceived loss of autonomy created by Navy patronage and prioritizing of research topics, anxious that the Navy was gaining too much authority over the purpose and direction of their research. In the early 1960s, this anxiety morphed into an open rebellion against the Director, chemist Paul Fye, a man with deep ties to the U.S. military who insisted that scientists should be responsive to the needs of their military patrons. The 1961 “palace revolt” involved a challenge leadership of the Director by faculty fighting to preserve what they understood to be “basic” science against a director wanting to move the institution further in the direction of military oceanography. The faculty revolt failed, the Director stayed on, and the Navy influence became even stronger than ever. The paper concludes with an overview of what Navy funding meant for American oceanography in Cold War, with a re-examination of the question of “distortion” as a category of historical analysis.

Oceanography, Navy, patronage, autonomy, basic science, applied science, Cold War, distortion

Knowing the Ocean from the Sky: Satellite Oceanography and the Three-Dimensional Ocean

Penelope K. Hardy, Johns Hopkins University

This paper considers the changes in the practice and culture of oceanography surrounding the 1978 launch of the first oceanographic satellite from the United States of America. Seasat 1—more formally the Ocean Dynamics Satellite, was funded by NASA’s Office of Space and Terrestrial Applications as the first satellite designed for the sole purpose of studying the global ocean and its interface with the atmosphere from space. To do so, it gathered a host of information, from ocean topography and wave height, to sea surface temperature and wind measurements, to atmospheric liquid water content. The shift to global, satellite study at the end of the twentieth century marked the latest in a long series of technological and methodological changes intended to provide scientists with a global view of the ocean-atmosphere system at an increasingly finer scale. Ironically, though, from its vantage point eight hundred kilometers above the sea surface, the satellite could not reach the depths that scientists had spent the last century trying to access more directly. Instead, it studied the ocean’s third dimension by precisely observing its two-dimensional surface, intimating details about the ocean’s bottom and internal structure by studying their signatures on the surface. Seasat marked too a shift in the culture of oceanographic practice. Over the course of the nineteenth and twentieth centuries, the distance between ocean scientists and their subject had become increasingly intimate, as technology for studying the sea in situ allowed a literal immersion in the research environment. Over this period, oceanographers increasingly defined themselves as scientists who went to sea. By the end of the century, though, satellites and other remote sensing technology brought about a shift in how ocean science was done. Instead of laboring through heavy seas to gather individual measurements, scientists who saw themselves as heirs to a tradition of heroic exploration now sat at their computer desks, slogging through oceans of data, overwhelmed by plenty. While these changes occurred neither instantly nor definitively—scientists still go to sea on ships, and they reach into the depths with instruments and submersibles—this paper uses Seasat to consider what “knowing” the three-dimensional ocean means to both science and scientists, and how that has changed with changing technologies of investigation.

Seasat; satellite oceanography; ocean science; NASA

The Politics of Ocean Currents: International Relations in the science of fluid movements

Samuel A. Robinson, University of York

Over the course of the 20th century the idea that the world's oceans were one homogenized whole, was challenged, investigated, and studied by oceanographers. Before World War I Norwegian fisheries' hydrographers studied water movements along the coast of Norway to better understand the migrations of fish populations central to a maritime economy. Through inter-war joint ICES studies in the Southern North Sea led by British, Dutch and German scientists. During the Cold War NATO's Bergen current meter, which recorded data electronically for the first time. To the present day ARGO project, the countries that border the North Sea region have been central to scientific studies of currents. In this paper I argue that localized research into the North Sea's currents and flows became key for understanding broader oceanographic issues and producing instruments that would be used across the globe.

Through an analysis of international oceanographic instrument production networks this paper charts the international relations of oceanography, arguing that 'science diplomacy' can be seen through other political lenses beyond large scale scientific meetings and international coordinating committees. Focusing on the work of James N. Carruthers, a British fishery hydrographer and prolific instrument designer, this paper highlights the importance of local knowledge in tackling global scientific questions. Furthermore, this paper argues that the opening up of the global ocean was shaped/co-produced by place, sovereignty, and economic considerations as seen through the instruments that provided new knowledge of ocean spaces.

This paper will demonstrate the importance of the local production of oceanographic instruments as a means of understanding global systems of water circulation. It further highlights the role of international collaborative efforts both before and after World War II in the construction of European oceanography. This is achieved through a study of science diplomacy seen through the lens of scientific instrument building. Whilst bridging Cold War science with earlier inter-war collaborative projects, it argues for a 20th century approach to understanding collaborations in the Earth Sciences, rather than a pre and during Cold War dialogue which has recently dominated scholarship.

Oceanography; North Sea; 20th Century; Earth Sciences; Politics

Historical Imaginations of an Open Polar Sea within the work of August Heinrich Petermann

Stephan Maximilian Pietsch, Leibniz Institute for Regional Geography

In the second half of the 19th century – the heyday of the European colonial exploration – the Polar Regions have been especially relevant. These so called last blank spaces on the maps can be interpreted as focal points of imperial efforts as well as projection surfaces of fantasies, aspirations and fears. Besides divers' reports of expeditions, fiction and landscape paintings, mainly cartographic representations have constructed, visualized and manifested these imaginations.

In my presentation, which also deals with some first results of my Ph.D. project regarding geographical imaginations of the Arctic, I will illustrate the thoughts mentioned above by introducing two maps of the famous German geographer and cartographer August Heinrich Petermann from 1852 and 1865. These cartographical representations of the Northern Polar Regions will be deconstructed based on the theoretical perspective of Derek GREGORY as geographical imaginations (see GREGORY 1994). The context of the vanishing of Sir John Franklin while searching the Northwestern Passage as well as the fantasy of a mysterious Hyperborea, which can be backtracked until the ancient times, is crucial for the interpretation of these two media.

It will be shown in the presentation that August Heinrich Petermann (re-)constructs the powerful imagination of an open polar sea behind a barrier of pack ice within his maps and explanatory notes. This is getting visual appealing especially by using cartographic methods of projection, generalization and the specific usage of color. The efficacy of this geographical imagination can be seen as it resonates within the planning and implementation of contemporary expeditions. With regard to the session on Science at the Oceans boundaries I would argue that especially the need to unveil the geography of the Polar Regions led to a professionalized scientific engagement within the 19th Century.

Geographical Imaginations; History of Geography; History of Cartography; Open Polar Sea; Arctic Regions

011. "The General Staff of Science": the Soviet Academy of Sciences between the Global and the Local :around the Field of Physics

"Empire of Knowledge" or "Island of Democracy"?

Reforms of the Russian/Soviet Academy of Sciences in Historical Comparison

Alexei Kojevnikov, University of British Columbia

Throughout the turbulent 20th century, under various kinds of political regimes, the Russian/Soviet Academy of Sciences typically performed at least two not fully compatible functions. One was that of the most prestigious, more or less autonomous, scholarly society, with the focus on representing the national scientific community, offering the ultimate expertise, and conferring the highest academic honors and privileges, including electing its own members and governing bodies. In its another role, the Academy functioned as a department of the government and served the state either as a court institution or as a substitute for a ministry of science that distributed resources for national R&D and administered major research institutes. Combining these different roles was not always easy: contradictions typically came to surface during the periods of serious political changes that demanded a reformulation of the Academy's governmental duties as well as a change in political loyalties. Several such conflicts and reforms that happened in the course of the century allow a comparative analysis of how the institution and its individual members managed and redefined over and over again a compromise between their heterogeneous identities.

Russian/Soviet Academy of Sciences; Political reforms; Academic identity

The Russian Physicochemical Society and the Soviet Power during the 1920s

Elena Sinelnikova, St. Petersburg Branch of Institute for the History of Science and Technology

The talk will investigate the relationship between the Russian Physicochemical Society and the Soviet Power in the 1920s. The study is based on a variety of sources, primarily archival materials of the Russian Physicochemical Society and government strictures that are stored in the Central State Archive of St. Petersburg.

The 1920s was the period of the construction of a new model of organization of science and the creation of new socialist institutions, besides many tsarist institutions and societies continued to function. The contradictions of that difficult time found reflection in the relations between the Russian Physicochemical Society and the Soviet Power. This paper will briefly outline key events of the history of the Russian Physicochemical Society until 1917 before focusing on its relations with the Soviet power. Special attention will be paid for the legislative and regulatory foundations of relations between the Soviet power and the Russian Physicochemical Society, powerful forms of control over

ICHST
2017

its activities, and governmental support for its work.

In general, the relationship between power and the Russian Paleontological Society in the 1920s can be described as contradictory. On the one hand, activities of the Russian Physicochemical Society were unacknowledged useful and met support of the Soviet power. For instance, publication of the Journal of the Russian Physicochemical Society was resumed by the Central Administration for Scientific, Scholarly-Artistic, and Museum Institutions (Glavnauka) in 1924 for the state account. On the other hand, the government exercised control over it. Throughout the 1920s the governmental control, influenced by the political changes taking place in the country, became stronger, and at the turn of 1920-1930s control was total.

The Russian Physicochemical Society; the Soviet power; the 1920s; scientific societies

Obninsk, 1955: The World's First Nuclear Power Plant and "The Atomic Diplomacy" by Soviet Scientists

Hiroshi Ichikawa, Hiroshima University

The first nuclear power plant in the world went into operation at Obninsk, a southern suburb of Moscow, in July 1954. One year later, the Academy of Sciences of the Union of Soviet Socialist Republics (USSR) held a large-scale international conference, the Session of the Academy of Sciences of the USSR on the Peaceful Use of Atomic Energy, as an international stage to demonstrate their scientific achievements in nuclear science and technology. Soviet scientists subsequently challenged the United States' nuclear advancement at the First United Nations International Conference on the Peaceful Use of Atomic Energy at Geneva. Could the Soviet scientists succeed in gaining international acceptance and prestige? Could they gain self-confidence? Drawing for the most part on previously classified archival sources in Russia, this paper tries to shed new light on these questions.

* Full text for the presentation has been already issued as a scientific paper in the international journal of the Japan History of Science Society, *Historia Scientiarum*, Vol.26 no.1 (August 2016). You can see it; http://home.hiroshima-u.ac.jp/ichikawa/ichikawa_4.pdf

Nuclear development, Soviet Union, Peaceful use of atomic energy, Obninsk, the Geneva Conference in 1955

The Road to the Stalinist Science Policy: Physicists versus Philosophers in the second half of the 1930s

Koji Kanayama, Tokai University

It can be pointed out that several characters are the components of Stalinist science policy: centralization, planning, bureaucracy, calling for the unification of basic and apply sciences etc. The Soviet Academy of Sciences (theme of our symposium) took an active role in shaping such policy. In addition to these ones, we may find other elements of the Stalinist Policy, and this paper will shed light on one of such characters, regarding the relationship of the Soviet authority with intelligentsia. What kind of relation would be desirable with the establishments of old society, when members of such class may be hostile to new government but at the same time be useful? Revolutionary authorities always regarded this question considerable, and Bolshevik party leaders are not exception. As is well known, Stalin made a contrast with Lenin by taking an oppressive direction regarding old scientific or industrial specialists during the days of the Cultural Revolution. The case of the Shakhty

affair (1928) is a clear example which shows this turning. However, in the middle of the 1930s the policy was turned again and Stalinist leaders often called for paying respect to specialists. In spite of the great amount of repressions in the time of the Great Terror, it is noteworthy that Stalinist policy, at least in the minds of the seekers, sought to make a harmonized relationship with natural scientists. In this paper I will show this direction by considering the case of philosophical/ ideological controversy over the concepts or theories of physics in the 1930s. As is known, philosophers of physics, or the representatives of the communist party took sometimes severe, critical attitudes toward Soviet leading physicists regarding the interpretation of physical concepts or theories. However, at the end of the Great Terror, they succeeded in pretending the harmonized, cooperative relationship with physicists. This has happened partly because some physicists responded to the Stalinist science policy and partly both philosophers and physicists found the proper language of sustaining both of Soviet ideology and the rigid scientific contents. I will try to put the history of the dispute on the context of making general policy of the Soviet Union.

Stalinism and science; physics in the Soviet Union; revolution and scientists

The development of physics in the time of Soviet ideology

Konstantin A. Tomilin, S.I.Vavilov Institute for the History of Science and Technology

The talk regards the debates between physicists and philosophers in the Soviet Union in terms of their attitude to the physical picture of the world. The establishment of dialectical materialism as the state ideology played in those discussions a negative role. In some cases (for example, with reference to "annihilation of matter", conservation law in weak interaction, the "equivalence" of mass and energy, etc.) philosophers turned to be closer to the truth than physicists. However, the use of ideological arguments (accusing opponents in idealism, Machism, etc.) did not contribute to the clarification of the truth. Behind the curtain of ideological arguments physicists could not see the positive meaningful essence of philosophers' argumentation, whereas philosophers were not able to present their arguments in physical language, understandable for physicists.

"ideological campaigns"; "physics"; "Academy of Science of USSR"

012. Histories of the measurement, definition and uses of time in science and technology

Absolute time and the measure of time

Daudon Vincent, Laboratory SPHERE University Paris Diderot

La première caractérisation du temps en philosophie naturelle apparaît dans les Principes Mathématiques de la Philosophie Naturelle, rédigés par Newton et publiés en 1687. Leur auteur y distingue un temps absolu, vrai et mathématique, qu'il appelle durée d'un temps relatif, apparent, et vulgaire, qui n'est qu'une partie de durée, et dont on se sert quotidiennement lors de la mesure. Avant lui, Galilée avait recouru au temps pour exprimer ses lois du mouvement, et l'avait aussi évalué expérimentalement de différentes manières: mesure du pouls, pendule, etc. Cependant, Galilée ne s'était pas penché sur sa définition! Ainsi, Newton laisse entendre qu'il existe deux temps distincts dont un sert à la mesure du temps. Et la distinction du « temps de ses mesures sensibles » se fait par l'équation astronomique, dont la nécessité « se prouve assez par l'expérience des horloges à pendule, et par les observations des

éclipses des satellites de Jupiter».

Cependant, en dépit de cette distinction annoncée par le professeur lucassien lui même, je montrerai que le temps newtonien doit être pensé comme un et mathématique.

De surcroît, penser le temps comme un et mathématique a des conséquences sur la mesure du temps et sur la conception du monde. Désormais, il n'est plus besoin de recourir à un temps pour les observations astronomiques et à un temps différent pour les phénomènes terrestres. Monde supra-lunaire et monde sublunaire ne font dorénavant plus qu'un. De façon similaire, la mesure du temps des phénomènes et leur description mathématique recourent à un même temps. Temps mathématique et temps de la mesure sont identiques. Enfin, le temps étant rationnel, la mesure du temps a un sens.

Absolute time; measurement of time; mathematic; Newton

Bernard Decaux and early research on atomic clocks in France

Eckhard Wallis, Sorbonne Universités, Université Pierre et Marie Curie, Institut de mathématiques de Jussieu-Paris Rive Gauche, UMR 7586, CNRS, Univ Paris Diderot, Sorbonne Paris Cité

In this contribution I want to study how the French national timekeeping system reacted to the invention of atomic clocks in the early 1950s, by describing the role of one of its principal actors, the radio-engineer Bernard Decaux (1899-1981).

Working in the Laboratoire National de Radioélectricité (LNR) in Bagneux close to Paris, an institution attached to the French post and telegraph administration, Decaux had been involved in French timekeeping from early on: the LNR had a long-standing relationship with the Bureau International de l'Heure (BIH), located at the Paris Observatory, and provided technical support related to electronics (time signals, quartz clocks). In 1950 Decaux was nominated as the BIH's „technical consultant for radiotelegraphy“.

Moreover his department at LNR adopted a pioneering role in the introduction of atomic frequency standards in France. Shortly after the first demonstration of a clock exploiting molecular resonance phenomena at the American National Bureau of Standards in 1949, Decaux' Department at LNR took up exploratory research in this direction. Not long after the presentation of Louis Essen's Cesium clock at the British National Physical Laboratory (NPL) in 1955, the LNR became the first center of atomic timekeeping in France. In 1957, Decaux' department acquired a commercial „Atomichron“ clock, produced in the US. At the end of that same year, a section of the newly founded Laboratoire de l'Horloge Atomique (LHA) of the CNRS under the direction of the physicist Alfred Kastler, took up its work in the premises of the LNR, in order to pursue the construction of atomic clocks.

As a trained electrical engineer, Decaux belonged to neither of the two groups usually cited when speaking about the transition from an „astronomical“ to a „physical“ second that took place in the second half of the 20th century. Following his activities will therefore in particular allow to highlight the role of engineering between physics and astronomy in the early research on atomic clocks in France.

time; measurement; atomic clocks; physics; engineering

“From time precision to Newton's law of universal gravitation.”

Meropi Morfouli, Observatory of Paris

According to Westfall “The very heart of the new natural philosophy was mechanics, the science of motion. Mechanics required the measurement of a third dimension, time. The creation of the new

world of precision was intimately connected to the success of science in learning to measure time." The study of local motion and the free fall in particular, was in the heart of the 17th century research on Natural Philosophy. The establishment of mathematical relations between time, distance, velocity and acceleration was a great challenge, a task carried out by Galileo with fruitful results used later by scholars, including Newton.

In his major work *Philosophiæ Naturalis Principia Mathematica* (1687) Newton presents his theory of universal gravitation. The title of this book reveals an important aim of its author: to introduce mathematical certainty in Physical studies.

In the 3rd book called *De Mundi Systemate* Newton demonstrates his theory. He compares two free falls: that of a heavy body near the Earth's surface and that of the Moon towards the Earth's center, considering only the force of gravity, the so-called "Moon test" (Prop. IV, Theorem IV). A little further in the same book (Prop. XIX & XX) Newton proposes the application of universal gravitation in order to solve several astronomical and physical problems, such as determining the Earth's shape. If the theory is correct (the inversed square law) then the force of gravity must be different to different latitudes of the Earth hence the shape of the Earth is not a sphere but an oblate spheroid. One way to confirm this hypothesis is to compare the different lengths of Seconds Pendulums ($T=2\text{sec}$) in different latitudes. In order to realise these mathematical demonstrations Newton makes use of a number of data, either from observations, essentially astronomical, or from results of calculus. Among the data used, certain concerns time measurement. In the case of the Moon Test one needs to be able to measure or calculate the time of the fall for a certain distance. In the case of the Shape of the Earth one needs to be able to determine the length of a time- measuring instrument. Time measurement thus is well implicated in this affair.

This presentation aims at giving a response to the following question: Is the emerging, increasing precision in time measurement a crucial element for the creation and the confirmation of Newton's Universal Gravity?

Time, Measurement, Precision, Newton, Gravity

20th century longitude: When Greenwich moved

Micahel Kershaw, King's College London

By the beginning of the 20th century, the meridian passing through the Royal Observatory at Greenwich had become an almost universal reference for place and time. It was the zero of longitude. But our current standard of zero longitude is about 100 metres away from the original, something only properly explained by very recent geodetic analysis. The standard's mobility needs historical context. Greenwich actually began to move – in two senses – decades ago. Metrologically, new wireless techniques for the determination of longitude and for the standardization of time were developed after the First World War; these introduced the notion of what was called a mean observatory, the position of which was no more than a mathematical construct that approximated Greenwich. The geographical fixity of a reference meridian was thus called into question. Practically, after the Second World War the Royal Observatory abandoned Greenwich for the clearer air of the countryside, leaving the original meridian devoid of up-to-date instrumentation that might confirm its position. In consequence, the Greenwich meridian and our standard of zero longitude drifted apart: Greenwich Mean Time no longer came from Greenwich. In this article I describe the wireless techniques that were applied to the determination of longitude during the 20th century. I explain how these, and their satellite successors, led to fundamental changes in our longstanding conventions of longitude. And I place these changes within the historiography of precision measurement and scientific progress.

Greenwich; Paris; Longitude; Time; Wireless

Kinds of Time

Richard Staley, University of Cambridge

The physicist who is best known for the excoriation of absolute time with the injunction that what was not measurable should have no place in physics, Ernst Mach also recognised diverse kinds of time – quite apart from the distinction between absolute and relative that had been at issue since the work of Descartes and Newton. This paper takes up two primary tasks in order to knit together these different features of Mach's work, which have rarely been considered together. The first aim is to explore the experimental work and observations that led Mach to distinguish between physiological, psychological and physical time, examining the grounds for his practical argument that the intimate interrelations between phenomena made it particularly difficult to isolate the experience of time itself. (This involves examining technologies or techniques of time-telling across several disciplines, and relates most closely to Mach's 1886 book *Contributions to the Analysis of Sensations*.) My second aim is to examine the philosophical and physical legacy of a further goal that Mach set physics, with his argument that we determine time only through change and that formulations of physical laws should reflect this. Stated most fully in his 1883 book *The Science of Mechanics*, this goal continues to be pursued by a small group of researchers such as Julian Barbour and Edward Anderson in their attempts to unify relativity and quantum field theories. (And it will involve us in an examination of the philosophy of time and physical theory.)

Time measurement; physiological time; psychological time; physical time; Ernst Mach

Clock transport, Hertzian waves and the reality of time dilation

Scott A. Walter, University of Nantes

Turn-of-the-century ether-drag experiments, studies of atomic spectra, electron theory, and the electrodynamics of moving bodies have all been seen to contribute to Einstein's concept of relative time in 1905. Following the practical turn in HST, Peter Galison suggested that to better understand the relativity revolution we should review its embedding in material cultures of clock coordination and telegraph networks. Two co-founders of relativity, Henri Poincaré and Albert Einstein were both engaged with these iconically-modern technologies, at the Paris Bureau of Longitudes, and the Bern Patent Office, respectively. Galison's technology-driven account of the theory of relativity can be extended by taking into consideration Paul Ditisheim's 1904 proposal to measure longitude differences by transporting precision deck watches, and Poincaré's 1909 illustration of time deformation, involving an observer in uniform motion who sends time-stamped position data wirelessly to a second observer considered to be at rest. Poincaré's wireless-based understanding of the physical significance of relative time provides a striking example of how a new technology can transform scientific imagination and understanding.

special relativity; time dilation; electrodynamics; Poincaré; spacetime

Physics, Astronomy and Clocks in the Redefinitions of the Second

Shaul Katzir, Tel Aviv University

Until 1960 the second was defined by the rotation of the earth around its axis, a scientific definition that followed the traditional reckoning of time. The rotation of the earth as the basis for time reckoning

was first replaced by a highly abstract astronomical definition of an idealized past annual revolution of the earth around the sun, which was in principle unobservable. Seven years later this definition was replaced by one based on the frequency of light emitted in an atomic transition. In this talk I will examine the reasons that led to the redefinition of the second. Although its definition was transformed from astronomical to physical, I will show that the process originated in theoretical problems in astronomy, and involved also considerations of physical theory and measuring instruments. Already in the 1860s a few astronomers suggested that the earth decelerates in its rotation in order to account for changes in the apparent motion of the moon. Half a century later, two developments convinced most experts that the earth indeed decelerates. 1) Within planetary astronomy it was shown that the assumption of decelerated earth makes the motions of the planets and the moon more consistent with the equations of celestial mechanics. In other words, a theoretical definition of time made the (classical) gravitation equations simpler and in accord with the observations. 2) The new quartz clock, which was invented for the needs of telecommunication, provided a means independent from the equations of gravitation to measure deviations in the motion of the earth. Measurements carried out from the 1930s to the early 1950s showed indeed such deviations. To relay on the quartz clock metrologists needed first to establish that it is more stable and thus accurate than time as defined by the rotation of the earth, which they managed to do despite the apparent circularity. Although central to the redefinition of the second the quartz clock did not satisfy metrologists as a basis of a new definition. The new atomic clock more accurate and based on a distinct atomistic phenomenon fitted better the ideal of defining the base units of physics and astronomy on true constants of nature. An ideal that has become only stronger with the success of the redefinition of the second and the metre and the recent reform in the definition of the kilogram and the other based units.

quartz clock; instruments; time; celestial mechanics; moon

013. The origins and the trajectories of physics in Latin America: between advances, lulls and storms

Plínio Sussekind Rocha: a physicist at the cinema

Bárbara Nóbrega, Universidade Federal do Rio de Janeiro

Ildeu de Castro Moreira, Universidade Federal do Rio de Janeiro

The engineer Plínio Sussekind Rocha was professor of Rational Mechanics, Celestial Mechanics and Mathematical Physics at the National Faculty of Philosophy (FNFi), from 1942 to 1969. The aim of this paper is to discuss Plínio's influence on the formation of the first generations of physicists and mathematicians in Rio de Janeiro. We will discuss also his work as a film critic, an activity by which he crossed the usual boundaries of science. We present, at first, a survey of his didactic works and articles on physics and of his texts on film criticism too. Plínio published few articles; for this reason, much of what is known about his life and work comes from testimonies collected from interviews with several of his former students and colleagues. Plínio began his research with an investigation on dielectric materials in the 1930's. As a gifted professor with a great culture and humanist vision, he encouraged several young students, both in secondary education - as happened with Elisa Frota-Pessoa and Neusa Amato, women pioneers of physics in Brazil - as well as in the university, to pursue scientific careers. In his lectures and extramural discussions he emphasized the philosophical aspects of science. Among his alumni, one of the highlights was Jorge André Swieca, an important Brazilian physicist, who left a touching testimony about Plínio's influence. On the side of cinema, Plínio was one of the creators and editors of *O Fan*, periodical of the Chaplin Club, published between 1928 and 1930. He also wrote about film in *Filme*, edited in 1947 by Vinicius de Moraes, and undertook a tireless struggle for the successful recovery of Mario Peixoto's *Limite*, that is considered one of the

best Brazilian films of all time. The fascination with the concept of time connected his dimensions as a scholar of physics and cinema. He had friendship with Mario Schenberg, renowned theoretical physicist and art critic, with whom he shared the humanist side. In 1969, Plínio was compulsorily retired by the AI-5, along with four other physicists and colleagues at the FNFi. He passed away three years later. Plínio Sussekund's case illustrates a kind of professional which is usually not considered in the studies of the history of science. He did not have a wide or prominent scientific production, although he made relevant contributions both to the formation of the first generations of professional physicists in Rio de Janeiro and to the culture and its connection to science.

History of physics in Brazil; Plínio Sussekund Rocha; Art and science; Brazilian cinema

Mission-oriented technological autonomy policies in semi-peripheral context: nuclear energy in Argentina as a space for experimental physics development

Diego Hurtado, Universidad Nacional de San Martín

Pablo Souza, Universidad Nacional de San Martín

Since the end of the Second World War, an experimental physics structural weakness in Argentina was related to the costs of “technologies for science” and the inadequate institutional capabilities for their acquisition and management. These deficiencies, together with the lack of knowledge demand by national industrial sectors, explain the marked bias of academic physics towards theoretical physics. As a counterpoint, the international rise of nuclear energy during the 1950s and the interest displayed by successive Argentine government administrations in the promotion of nuclear policies focused on autonomous technological goals made possible the creation of an institutional environment, whose epicenter was located in the National Atomic Energy Commission (CNEA), where physicists were able to promote the development of experimental physics and their leading role in some strategic technological developments outlined by the nuclear policy. We intend to analyze the participation of CNEA's physicists in the following processes: (i) the purchase and commissioning of particle accelerators; (ii) the design and manufacture of nuclear research reactors; (iii) the creation of the firm INVAP as a CNEA's spin-off and the development of gas-diffusion uranium enrichment technology; and (iv) since the 1990s, the decisive influence of local nuclear sector in the creation of the Argentine space agency CONAE (National Space Activities Commission) and INVAP diversification towards the construction of Earth observation satellites. A relevant conclusion for a semi-peripheral country is the importance of mission-oriented technological autonomy policies as a vital factor for institutional stability, which is needed as a condition for the development and diversification of experimental physics.

Experimental Physics; Nuclear Energy; Argentina; Semi-periphery

Feynman in Brazil: from quantum electrodynamics to physics teaching

Ildeu de Castro Moreira, Institute of Physics - Federal University of Rio de Janeiro

Between 1949 and 1966, the American physicist Richard Feynman came to Brazil a few times, interacted with local physicists, gave courses and lectures, and participated in events at the carnival in Rio de Janeiro. The purpose of this communication is to analyze his interaction with researchers and students in Brazil, to discuss the research activities carried out, the lectures he held and the courses he taught, in order to discern the local impact of these activities. In 1949, Feynman gave a lecture on quantum electrodynamics at a seminar organized by the Brazilian Academy of Sciences, in

which he presented the recent results obtained by him, Schwinger and Tomonaga. The original version of this conference, in Portuguese, was written with the help of two students. The content of this conference was located recently and is presented here for the first time. Feynman also gave, at this time, a long interview on quantum electrodynamics in the newspaper *A Noite*. In 1952, he returned to Brazil for a period of a few months, on sabbatical leave, for research and teaching activities at the Brazilian Center for Physical Research (CBPF). In this period he taught at the School of Engineering on electromagnetism and on nuclear physics and quantum electrodynamics at the CBPF. He made a paper on the theory of meson with the Brazilian physicist José Leite Lopes (On the pseudoscalar theory of the deuteron, 1954). According to Leite Lopes, Feynman's ideas on superfluidity were developed in another visit to Rio de Janeiro in 1953. In 1952 and 1963, Feynman lectured in Rio de Janeiro on physics teaching, based on his local teaching experience: "My experience as a teacher in Brazil" (May 1952) and "The Problem of Teaching Physics in Latin America" (I Inter-American Conference on Physics Education, June 1963). His experience with physics teaching in Brazil became famous through one of his books, "Surely You're Joking, Mr. Feynman!" (1985), which is a worldwide bestseller due to the scientific importance of his author, to his competence as a teacher and to his ironic and direct style. In the book he describes situations of his interaction with Brazilian students, which illustrate his criticism of the physics teaching based on memorization and without the investigative and critical dimension. We will also discuss the content of these two conferences and we will try to evaluate the possible local influence of his observations, criticisms and suggestions on the teaching of physics.

Feynman in Brazil; history of physics in Brazil; physics teaching in Latin América; history of quantum electrodynamics

The Heritage of the Good Neighbor Policy: The role of the Rockefeller Foundation in Financing the Brazilian Physics after the WWII

Indianara Silva, The State University of Feira de Santana

The Brazilian physics took its first step to the international scenario with the publication in 1939 of the article "Simultaneous Penetrating Particles in the Cosmic Radiation" by our physicists from the University of São Paulo Gleb Wataghin, Marcelo Damy de Souza Santos and Paulus Aulus Pompéia. This article called attention to the American physicist Nobel Laureate Arthur Holly Compton who was interested at the time in the cosmic rays' field. It was the beginning of the scientific collaboration between the Brazilian team and Compton. As an illustration of it, Pompéia went to the US in order to collaborate with Compton's research group at the Chicago University. In 1941 Compton decided to visit Brazil as a scientific endeavor, apparently, to participate in a cosmic rays conference. Freire and Silva (2014) have shown, however, that Compton's 1941 trip was much more a diplomatic movement, rather than scientific, to conquest Brazilian hearts in a dark time, the context of the WWII, as an effort led by the Office for Inter-American Affairs under Nelson Rockefeller. The idea behind Compton's trip was to intensify what is well-known as good neighbor policy promoted by the US to create an empathy environment with the Latin America. The Compton mission was a successful one. As a way of maintaining the empathy spirit, when Compton came back to the US, the collaboration with Brazilian physicists increased significantly. He turned out to be a kind of consultant of the Rockefeller Foundation related to providing, or not, financial support to the Physics Department at the University of São Paulo. This talk will discuss the role of Rockefeller Foundation in financing Brazilian physics as a heritage of the good neighbor policy after the WWII.

History of science, Brazilian physics, Rockefeller Foundation, Financing

Einstein's theory of relativity presented to Amazonia

Luís Carlos Bassalo Crispino, Universidade Federal do Pará

Marcelo Costa de Lima, Universidade Federal do Pará

We report the introduction of Einstein's theory of relativity in the Brazilian Amazonia, happened during the passage by the city of Belém, in the state of Pará, of the British scientists Andrew C. D. Crommelin and Charles R. Davidson, prior and after the measurements performed by them in the city of Sobral, in the state of Ceará, during the total solar eclipse of May 29, 1919.

Relativity; May 29 1919 Eclipse; Amazonia

Cosmic-ray air showers and the emergence of experimental research in Brazil

Marcelo Augusto Leigui de Oliveira, Federal University of ABC (UFABC)

Nelson Studart, Federal University of ABC (UFABC)

In 1940, Gleb Wataghin and his brilliant young physicist Marcelo Damy de Souza Santos and Paulus Aulus Pompéia detected an unexpected component of very penetrating particles, able to pass through tens of centimeters of lead. This component has been named "penetrating showers". The discovery was discussed in international forums, as the Symposium on Cosmic Rays held in Rio de Janeiro in 1941 with the presence of Arthur Compton and in a series of symposia held in Berlin in the years 1941 and 1942. At these symposia, Heisenberg supported the Wataghin's interpretation of the "multiple" production of mesons against the "plural" one, with the showers resulting from collisions of single primaries.

The experiment was performed in the city of São Paulo and the results were published in The Physical Review and should be considered the first Brazilian experimental paper appearing in an international distinguished journal. Besides, it also motivated new experiments on the penetrating showers with more advanced detection apparatus that led to new discoveries, in special fifteen years later, the "V-particles", which nowadays are known as "strange particles", fundamental pieces of the standard model of particle physics.

In this paper, we discuss the main aspects of this seminal experiment, from a historical point of view, exploring the connections between the Brazilian scenario at the time and further developments in modern physics.

Gleb Wataghin, history of physics in Brazil, penetrating showers

Public communication of physics at the beginning of the 20th century, case comparison

María Cecilia von Reichenbach, Museo de Física, Facultad de Ciencias Exactas, Universidad Nacional de La Plata. CCT La Plata, CONICET

We present the study of three lectures given by physicists from the Instituto de Física of the Universidad Nacional de La Plata, one of the first physics centers in Latin America. We analyze the dissertations and their context to consider how they reflect different profiles of science, recipients, contents and discourse.

The first conference was given by the Institute Director Tebaldo Ricaldoni in 1907, in the "University Extension Conference Cycle", organized for general public by the university Public Library. With the

title "The Three Units", he talked on various physics topics, and performed experimental demonstrations.

His German successor Emil Bose inaugurated the new facilities of the Institute of Physics in March 1911 with a conference whose public included public figures, journalists and academics. To the spectacular presentation, with impressive experimental demonstrations, was later attributed the renovation without cuts in the budget for the university in the Deputies' Chamber.

Also with demonstrations, Professor Margarita Heiberg de Bose's lecture on "Filtered ultraviolet light and its applications in legal and historical research" was held at the Sociedad de Historia Argentina in September 1935.

Scientific divulgation; physics; Argentina

Crisis and opportunities in the beginning of the institutional development of physics in Mexico

María de la Paz Ramos Lara, Universidad Nacional Autónoma de México

In Mexico, the first Physics career and the first Institute of Physics were created in 1935 and 1938, respectively, in the National Autonomous University of Mexico (UNAM), the most important institution of higher education in the country. However, this University was founded in 1910, with the objective of professionalizing scientific and humanistic disciplines and developing scientific research, the project could not materialize for the physical sciences, partly because of the beginning of the Mexican Revolution and also because the national economy was eminently supported by foreign investments that oppressed all those scientific fields associated with technological innovation and industrial development. The economic, political and social crisis of the country generated conflict between the University itself and the government apparatus, a situation that led to the struggle for autonomy, acquired in 1929. From that year, the university began a deep process of internal restructuring, which was utilized by Engineer Ricardo Monges López who demanded the professionalization of physics and the institutionalization of scientific research. Finally he created the Faculty of Sciences and the Institute of Physics at the UNAM, both fundamental in the consolidation of the physics at national level. In 1950 the Mexican Society of Physics was created (which agglutinated all the physicists of the country) and in 1952 began the journal *Revista Mexicana de Física*. In 1956 the first effort was made to bring together the Latin American community (attended by José A. Balseiro and Alberto Mallmann from Argentina, Siguelo Watanabe, José Goldemberg and Guido Beck from Brazil, and Marcelo Alonso from Cuba) and other countries (United States, France, and India), when Marcos Moshinsky organized the Summer School of Physics in Mexico City, three years later called Latin American School of Physics (ELAF). Certainly, the Institute of Physics of the UNAM has been a cornerstone in the development of physics in Mexico. Among its most important achievements of the 20th century was the creation of the National Institute of Nuclear Research (ININ), where the first nuclear reactor was installed, in addition to its efforts to create specialized institutions in nuclear sciences, materials science, renewable energies, nanosciences and nanotechnology and complexity sciences, among other.

Physics in Mexico, Science Faculty, Institute of Physics, National Autonomous University of Mexico, crisis and opportunities

Teaching and appropriation of Newtonian physics in Colombia 1780-1850

Martha Yaneth Cerquera Cuellar, Universidad del Valle

Luis Carlos Arboleda, Universidad del Valle

The analysis refers to three different modalities of appropriation and teaching of Newtonian physics in Colombia. The dynamizing agent of the first moment was José Celestino Mutis (1732-1808) who promoted the teaching of the new physics (Natural Philosophy) in the Colegio del Rosario in Santa Fe of Bogotá from the early 1760s, facing the religious monopoly of Higher education with its famous controversy over the Copernican system. By 1772 Mutis deepened the appropriation of Newtonian physics and undertook the task of teaching "Principia" in the Geneva edition by Leseur and Jacquier, producing as a remarkable historical fact the first (unpublished) Spanish translation of this work. The second moment was the teaching of physics by José Félix de Restrepo (1760-1832), first at the Colegio de San Bartolomé in Bogotá, and later at the Seminario de San Francisco in Popayán. In these contexts two practices of teaching of the physics coexisted, the one took as referent the Thomist text of Goudin, and the other the text of experimental physics of Nollet. This eclectic teaching continued during the first decades of the nineteenth century and only began to change when Francisco José de Caldas (1748-1816) inherited in 1808 the chair of Mutis in the Colegio del Rosario. Then begins a third moment of change in the appropriation and teaching of the knowledge of the new physics, particularly through the Haüy treaty. This communication will examine the sui generis conditions of introduction and institutionalization of this work in the cathedra in Bogotá (1826), as a vector of transmission of a discourse of physics in opposition to the Restrepo approach. Finally, it will be shown that in the period of study, the physics course, as bearer of the notion of "usefulness", constituted a canon of formation in different professions in society, first in jurisprudence and theology, and later in Medicine and military engineering.

Physics; teaching; appropriation; knowledge

Laser Raman spectroscopy and the Brazilian physicist Sérgio Porto – Science and Technology, developing countries, and the relations between West and East

Walker Antonio Lins de Santana, Institute of Physics, Federal Univ. of Bahia

Laser comes from Quantum Physics and it was a Brazilian physicist who discovered laser Raman spectroscopy and contributed to its introduction in the western world and in the eastern world. This introduction occurred through the publication of the article Ruby Optical Maser as a Raman Source in the year 1962. In turn, one year before and after the publication of this article, Brazilian physicists study and produce a variety of lasers with diverse applications. In the following decade the researches intensify and the Brazilian physicists produce laser for medicine, chemistry, industry and physics, as well as for the telephone communications system with the production of fiber optics, and for the Brazilian nuclear program through isotope separation, contributing to its relations with South America and North America as well as with Europe and Asia. The aim of this work is to report the onset of laser academic research in Brazil enhancing the professional life of the Brazilian Physicist, Sérgio Porto. The period of research is 1959-1979. Specific aims are to describe the use of laser in Brazil and its social, economical and political implications focusing in: use of laser in various sciences; origin and management of related institutions; earliest arrangements between industry and sciences aiming developing of Brazilian laser technology and first physicist patents. Results of this research are based on documentation from archives of FGV, Sérgio Porto Archives and National Congress Archives and interviews with physicists, economist, politician and doctor. The scientific journal thus refers to him: Professor Sérgio Porto ranked among the foremost Brazilian physicists. As a Professor of Physics he was a Faculty member at the Instituto Tecnológico da Aeronáutica in Brazil from 1954 to 1960 and

at the University of Southern California from 1967 to 1973. At the time of his death he was at the Universidade Estadual de Campinas, Brazil, where he was the Dean of Science. He was a staff member and supervisor at the Bell Telephone Laboratories from 1960 to 1967 where he initially applied the laser as a source for Raman spectroscopy. (J. Raman Spectroscopy, December 1979, Vol. 8, No. 6, p. 352). Finally, it is questioned why its scientific recognition in Brazil does not correspond to what it has in the physics and spectroscopy communities of advanced countries in science and technology.

laser in Brazil and relations between West and East; fiber optics in Brazil and the physicist Sérgio Porto; laser medicine in Brazil and physicist Sérgio Porto; physicist Sérgio Porto and the Brazilian nuclear program; history of physics and social science in Brazil

Recherches en Physique Physique de l'État Solide a Brésil et Bahia

Wanderley Vitorino da Silva Filho, Universidade Federal da Bahia
Martha Cecilia Bustamante, Université Paris 7

Les premières recherches en Physique de l'État Solide (PES) ou plus largement connue Physique de la Matière Condensée (PMC) en Brésil sont des premières années du siècle XX.

Le début de ces recherches est de l'année de 1934 et l'attribuer au physicien allemand Bernhard Gross. Gross a été un papier important dans la formation de physiciens par exemple Costa Ribeiro, Sérgio Mascarenhas. Ces physiciens ont commencé leurs recherches en PES dans l'Université du Brésil et de l'Université de São Paulo, campus de la ville de São Carlos.

Des autres institutions qui aussi ont fait des recherches en PES à partir des années de 1950, comme l'Université de São Paulo de la ville de São Paulo, le Centre Brésilien de Recherche Physique (CBPF) et l'Institut Technologique d'Aéronautique (ITA).

En 1969 il a été réalisé le 1^o Symposium National de Physique de l'État Solide et sciences des matières en São Carlos et organisé par Sérgio Mascarenhas. Ce symposium a recueilli environ 30 participants.

Le début des années 1970 l'Université de Campinas (Unicamp) a commencé former les chercheurs (masters et docteurs) et la formation en PES a été bien cherché.

Il a été à partir de la Unicamp que le physicien Ivan Cunha a formé par l'Université Fédérale de la Bahia (UFBA) qui était à Unicamp, lui a été invité pour le directeur de l'Institute de Physique de l'UFBA, Humberto Tanure, pour crier un programme en PES pour former chercheurs (masters et docteurs) en PES. En commençant les recherches en PES dans l'état de la Bahia.

L'objectif est de présenter le scénario de la FES au Brésil à la fin des années 1960 et le début de la recherche dans l'état de la Bahia.

"Histoire de la physique"; "histoire de la physique au Brésil""Physique Physique de l'État Solide"

014. Quantum Cultures: Historical Perspectives on the Practices of Quantum Physicists

Quantum Cultures during the prehistory of Quantum Gravity: Léon Rosenfeld's early contributions to Quantum Gravity

Alessio Rocci, University of Padova
Giulio Peruzzi, University of Padova

This talk analyzes the early work of Léon Rosenfeld, one of the pioneers in the search for Quantum Gravity, the supposed theory reconciling quantum principles with General Relativity. We start with a

brief discussion of the role of quantization procedures during the prehistory of Quantum Gravity, in order to set Rosenfeld's figure in his historical background. We then describe how and why Rosenfeld attempted to face this problem in 1927, underlining the role of his mentors: Oskar Klein, Louis de Broglie and Théophile De Donder. Rosenfeld asked himself for the first time how quantum mechanics can reproduce the Reissner-Nordström metric in the weak field limit, a picture that the quantum field theory would reproduce more than 45 years later. Inspecting the quantum corrections to the flat metric, Rosenfeld and De Donder also introduced a sort of general relativistic version of Bohr's correspondence principle. We finally discuss the role of this early work in the constitution of the field theory approach to Quantum Gravity.

Léon Rosenfeld; History of Quantum Gravity; quantum metric; correspondence principle

Between accelerators and mountains: The High Energy Physics research in the Brazil-Japan Collaboration

Antonio Augusto Passos Videira, Department of Philosophy – State University of Rio de Janeiro
Heracio Duarte Tavares, Federal University of Rio de Janeiro/ CNPq

The Brazil-Japan Collaboration (BJC) for the study of subatomic particles existed between 1962 and the mid-1990s. Its origin dates back to the research program conceived by Gleb Wataghin and Giuseppe Occhialini at University of São Paulo (USP) during the 1930's. Their way of teaching has contributed to the formation of a whole generation of scientists in Brazil. Among their students was César Lattes, who has participated in the discovery of pi meson, in the end of the 1940's, working with two different techniques: (1) Exposition of emulsion plates to cosmic rays at the Mount Chacaltaya, at the Cordillera Real in Bolivia, and (2) the exposition of the same kind of emulsion plates to the beams of the particle accelerator at the Lawrence Laboratory in Berkeley. Lattes' transit between these two techniques reappeared, in some sense, in BJC work.

During the existence of BJC, Lattes advised dissertations of Brazilian students in which comparisons between data collected from cosmic rays and data collected using particle accelerators were performed on a regular basis. In addition, examining BJC's papers and dissertations, we can see techniques – e.g., the measurement of subatomic particles angle tracks – as well as scientific instruments – e.g., the emulsion chamber – that were also used by other particle physics groups around the world. BJC's students and senior researchers were the developers and users of some of these scientific tools, building up an environment of investigation conjugated to teaching. We believe that part of BJC's environment was guided by Lattes' way of reasoning, who mixed up data analyzes from cosmic rays and particle accelerators in his scientific trajectory.

Our objective in this talk is to describe BJC members' practice trying to see whether (and, if so, how) local cultural aspects influenced their scientific performance. Beyond that, we aim at understanding Lattes' scientific identity among different practices of particle physics. Nowadays, the comparison of results on particle physics, obtained from cosmic rays and particle accelerators, is considered "normal practice" by many physicists in the field. From a historical point of view, Lattes seems to have had a prominent role in this process.

César Lattes; Cosmic Rays; Particle Accelerators; Brazil-Japan Collaboration; Mount Chacaltaya Observatory

Quantum Fringes: Hopes for nonlinear field theories by Born, Schrödinger, and Heisenberg, 1930s to 1950s

Arne Schirrmacher, Humboldt University, Berlin

Beams of light produce interference fringes consisting of bright and dark bands in overlapping regions of propagation depending on whether they are in phase or out of phase with one another. Essentially, I will turn this scientific phenomenon from the field of physics into a social, political, and disciplinary phenomenon that pertains to the community of physicists in the eras of looming, hot and cold war. Starting from the ‘fathers’ of quantum mechanics Max Born, Werner Heisenberg, and Erwin Schrödinger, who quickly had become beaming heads of a big family of physicists of the quantum breed, I will describe the trajectories, which brought them to the fringes of both the map of geographical centers of 20th century physics and the mainstream research fields. All three decoupled from the broader scientific developments at some point due to tectonic shifts in the political and disciplinary landscapes as well as in the practices and scales of more ‘industrialized’ research. And all of them saw one alternative field of research in non-linear field theories allowing them to strive for new and seemingly revolutionary breakthroughs of a similar order as quantum mechanics. Is it possible to disentangle the interference of political forces, which made Born and Schrödinger leave their home, research community, and national culture, as well as the respective conditions in Scotland and Ireland where the two emigrants found accommodation (and expectation and bright developments at fringe locations, too), and the scientific merits of non-linear theory, which made them enthusiastic and prolific researchers, while many of their former colleagues were dealing with controlled and uncontrolled production of nuclear energies? Similarly, why did Heisenberg with his problematic baggage of having had a leading role in Third Reich physics voluntarily go out of phase with the mainstream theoretical physics during the Cold War. when he pushed his ‘world formula’ just at the time when his new political role had peaked, leaving Max Born, politically rather on a different side, remarking to Einstein “It causes me some amusement that Heisenberg has taken up my old idea of non-linear electrodynamics, and has applied it, *mutatis mutandis*, to meson fields.” It seems to come naturally to quantum cultures that they develop bright and dark bands of interference fringes, when exposed to actual real historical conditions.

quantum theory; emigration; Max Born; Erwin Schrödinger; Werner Heisenberg

Quantum “cultures”? The diversification of practices in 20th century quantum physics

Christian Joas, History Department, LMU Munich

What distinguishes a molecular physicist from a quantum chemist? How incompatible are the practices of high-energy and condensed matter physicists? Are “first-principles” and “models” condensed matter physicists really part of one and the same field of research, or at least part of the same subdiscipline of physics? What is the difference between a nuclear structure theorist and a Brueckner many-body nuclear theorist? And were, say, Einstein or Schrödinger not only proponents of interpretations of quantum physics that were different from those of, say, Bohr and Heisenberg, but representatives of different quantum “cultures”?

Often subtle (and sometimes less subtle) distinctions of culture, values, terminology, and habit permeate modern physics, and if one aims at describing both the intellectual and institutional dynamics of quantum physics in the twentieth century and beyond, one should not disregard them, but rather embrace their astonishing variety. In my talk, I will reflect upon the notion of quantum “cultures” using examples from my own research and that of others. I will also discuss whether “culture” really is a helpful concept in trying to make sense of the various developments in the

history of quantum physics that are connected to the formation of research schools, local traditions, new fields, and specialized subdisciplines.

history of physics; history of quantum physics; history of many-body physics; institutionalization; specialization

The prehistory of entanglement: Schrödinger and the development of the Einstein-Podolsky-Rosen experiment

Christoph Lehner, Max Planck Institute for the History of Science
Jos Uffink, University of Minnesota

In “The Present Situation in Quantum Mechanics,” his 1935 response to the famous paper by Einstein, Podolsky and Rosen, Erwin Schrödinger coined the word “entanglement” (Verschränkung) to describe the impossibility of decomposing quantum mechanical states of composite systems. Einstein, Podolsky, and Rosen had exploited this formal property to argue that quantum mechanics is incomplete in its description of reality. Schrödinger rejected their conclusion, but he was the only one among the founding generation of quantum physicists to agree that they had pointed to a fundamental problem in the interpretation of quantum physics.

Schrödinger’s research notebooks offer a rich and hitherto unused source about the prehistory of these two seminal papers. They show not only that Schrödinger had been long aware of the phenomenon, already in 1926 he struggled with it as a problem for a physical interpretation of wave mechanics; they also document where Einstein got the original idea for the EPR thought experiment from, a question that so far only speculative answers have been given for.

Quantum Physics; Entanglement; Schrödinger; Einstein

Masers in Comparative Perspective: the Soviet and American approaches to the invention of the maser

Climério Paulo da Silva Neto, Universidade Federal do Oeste da Bahia

In the first years of the 1950s, two remarkably different scientific traditions converged to the invention and development of masers, and later, lasers. On the Soviet side, Alexander Prokhorov and Nikolai Basov had been trained in the Mandelstam school of oscillations, a scientific tradition that had at its core a theory of oscillations conceived to be a universal language in physics. That theory was instrumental to the Soviet approach to the invention of the maser. On the American side, Charles Townes, James Gordon, and Herbert Zeiger had been trained in a mostly experimental tradition shaped above all by the wartime radar work and the emergence of radio spectroscopy in its aftermath. The goal of this paper is to inquire on the similarities and differences in the way those two groups integrated the quantum effects of stimulated and spontaneous emission in their research on radio spectroscopy to create the first masers. My main claims are that for their different backgrounds, American and Soviets physicists had different conceptual understandings of the maser and that the availability of a mature theory on the Soviet side was that primary factor underlying those differences. They nevertheless found common ground in the experimental practice.

Maser; school of oscillations; Alexander Prokhorov; Nikolai Basov; Charles Townes

When did particles become “indistinguishable”? Quantum cultures and the interpretive flexibility of mathematical-theoretical apparatus in the emergence of quantum statistics

Daniela Monaldi, York University, Toronto

Quantum physics has changed the concept of particles profoundly. This change—commonly referred to by the shorthand “indistinguishable particles”—did not stem from a deliberate theoretical choice or a single experimental finding. It was, rather, the result of prolonged efforts to arrive at a unified interpretation of the mathematical-theoretical apparatus of the quantum statistics and the quantum mechanics of multi-particle systems. Several interpretations were sketched in the 1920s and 1930, as the possibilities, limits, and conditions of the quantum theoretical technologies were probed on different physical systems in different contexts of theoretical and experimental practice. This paper examines some of the early formulations and uses of quantum statistics by Albert Einstein, Enrico Fermi, Paul Dirac, Edwin Schrödinger, Werner Heisenberg, and others, showing how professional cultures and traditions shaped diverse theoretical approaches. I will tentatively argue that, although important remarks were made early on especially in the context of the wave-particle debates following the formulation of matrix and wave mechanics, the first extended articulations of a new conception of particles that aimed at reconciling the different uses and views emerged only after WWII, in with the reconfiguration of fields such as nuclear physics and particle physics, low temperatures, and solid state physics, and their instrumental-experimental-theoretical cultures.

quantum statistics, interpretive flexibility, quantum cultures

The electron before quantum mechanics

Diego Dias Uzêda, Centro Federal de Educação Tecnológica Celso Suckow da Fonseca

Towards the end of the 19th century, J. Larmor, guided by G. F. Fitzgerald, and H. A. Lorentz postulated a new theoretical entity, the electron, with well-defined characteristics and properties. One of the problems left by J. C. Maxwell's electromagnetic theory was the problem of the nature of the so-called Amperian current.

In hindsight, electrolysis already pointed to the existence of a unitary charge in the current, but the problem is just to investigate how the idea of the unitary charge, the electron, arose.

Lorentz conceives the electron as a material particle in a stationary ether; it mediates interactions between the medium and a pervasive ether.

However, Lorentz did not describe the mechanism of these interactions, nor the structure of the ether; there is no indication of the dimensions of the electron, nor the means to find them. To Larmor, the electron was a singularity, a center of stress in the ether, whose function is to break the rotational elasticity of the ether; this elasticity had been introduced decades earlier by MacCullagh to explain the transversal nature of the propagation of light, and was a property of a nonconducting medium.

Our talk presents a critical analysis of the role of the electron in the theory of Larmor-FitzGerald, and in the theory of Lorentz. The work discusses the problems these theories intended to solve, the function the electron played in each theory, and what properties it was assumed to have in order to perform this function. In the Maxwellian tradition, with which Larmor has been associated by many historians, the electron is related to a model of the ether, and is a phenomenon in the ether. Lorentz was a Continental physicist; on the continent Helmholtz's interpretation of Maxwell's equations prevailed, and the view that charge could be material. Emphasis is given to the similarities of the two traditions, the Maxwellian and the Continental, if they could be and were indeed reconciled.

Our talk also intends to investigate whether J. J. Thomson's theoretic background, might have helped him in postulating that the corpuscle found by him is a constituent part of matter.

electron; Lorentz; Larmor; Thomson

Entanglement: A History of Neglect

Elise Crull, The City College of New York

In this talk I will explore the extent to which the concept of entanglement was both “in the air” and understood to be an important (and importantly quantum) feature characterizing modern physics, in years prior to Schrödinger’s coining the term in 1935. In particular, I will investigate little known primary resources (including correspondence, manuscripts, symposia, etc.) generated by or shared among members of the philosophy, mathematics and physics communities in Göttingen, Leipzig and Copenhagen in the late 1920s/early 1930s.

Such an investigation, I claim, yields evidence that a nascent understanding of entanglement importantly shaped different clusters of theoretical work in pre-war Europe. A question then naturally arises: if entanglement considerations influenced philosophical, theoretical, and perhaps even experimental approaches to quantum mechanics before WWII, how was its extreme importance somehow then “forgotten” well into the 1980s? Discussion of how early 20th Century physicists appreciated and took to heart this characteristic feature of quantum mechanics in a way that late 20th Century physicists and philosophers have failed to do will, I think, help us move forward with foundational research in the present.

Entanglement; Quantum Mechanics; History of Modern Physics

Worldviews and Scientific Research: The Case of the Rise and Fall of the S-Matrix Program and the Bootstrap's Philosophy (1960's-1970's)

Gustavo Rodrigues Rocha, Universidade Estadual de Feira de Santana

In a 1986 article Steven Weinberg remarked that “the history of particle physics in the last thirty years or so has been a story of oscillation between two broad lines of approach to the underlying laws, two approaches that might briefly be called quantum field theory and S-Matrix theory” (WEINBERG, 1986, p. 135). Although Weinberg’s remark refers to the period ranging from the early 1960’s to the early 1980’s, the S-Matrix theory was first developed by Heisenberg in the early 1940’s. Heisenberg was motivated by three reasons to introduce his S-Matrix program. First, in the early days of quantum field theory, Heisenberg, along with Born, Jordan and Dirac, discovered that, in perturbative calculations of QFT, many integrals were divergent. Second, Heisenberg wanted to tackle the question of cosmic rays, which, from a theoretical standpoint, were not well covered by QFT. Third, Heisenberg interpreted cosmic ray showers as indicating the existence of a fundamental length. Heisenberg published several articles on the S-Matrix theory between 1943-1948.

The S-Matrix program flourished again in USA throughout the 1960’s/70’s. Geoffrey Chew and Henry Stapp were among the first in Berkeley to develop a new S-Matrix program. I will focus my presentation on the steps taken by Chew that transformed his program into a worldview: (i) the Chew’s rejection of QFT (1961 La Jolla Conference), (ii) the distinction between partial versus complete bootstrap (1968 article), and (iii) the consolidation of a bootstrap philosophy of nature (popularized by his student, Fritjof Capra, in his famous 1975 book).

S-matrix, history of physics

Beyond ideology: Mathematical and epistemological foundations of Vladimir Fock's approach to Quantum Theory – Considerations on a marginal quantum culture (1930-1970)

Jean-Philippe Martinez, Université Paris 7 – Paris Diderot & Université de Genève

Nowadays Fock is a familiar name to many physicists, especially in Quantum Theory. Contributions like the Hartree-Fock method or the Fock space are recognized as fundamental elements for the discipline. Usually regarded as a member of the Copenhagen school, Fock is also known for his endorsement of dialectical materialism, the official Soviet ideology. Thus, he developed an alternative interpretation of Quantum Mechanics which resulted in a dispute with Niels Bohr. Although the dispute is often mentioned by historians of science, the real content of Fock's interpretation of Quantum Mechanics remains relatively unknown. Indeed, the meeting between the two physicists in Copenhagen in 1957 is primarily described for its ideological and political dimensions. The dispute is often portrayed as an example of the harmful effects the Soviet regime had on scientists. Fock's rhetoric, which takes up some features of the Soviet discourse, can be invoked to explain this situation.

But from a closer analysis of different papers on Quantum Mechanics, we can observe that the position held by Fock had a real and profound scientific content. It raised real questions for the whole understanding of the theory. Beyond what can be interpreted as pure ideological features imposed by dialectical materialism, we observe a physicist engaged in some of the most widely-spread questions concerning physics: the role of mathematics, reductionism, and realism. Considering the whole picture, an account of Fock's global approach to physics can be established. An approach that he applied not only to Quantum Mechanics but also to General Relativity. In the case of quantum theory, we can see the emergence of a singular quantum "culture" that he long tried to promote. But Fock was in a peculiar position, distinguishing himself not only from the Copenhagen orthodoxy, but also from statistical interpretations of Quantum Mechanics being traditionally promoted in Marxists circles. Fock criticized both sides, and was criticized by them in return. He thus remained very isolated.

The present contribution aims at giving a better account of Fock's understanding of Quantum Mechanics and the role played by dialectical materialism. It also intends to be a case study of a marginal quantum culture stuck between two very influential fronts, and the object of ideological and political influences.

Fock; Soviet Union; reductionism; realism; interpretation

The prehistory of entanglement: Schrödinger and the development of the Einstein-Podolsky-Rosen experiment

Jos Uffink, University of Minnesota

Christoph Lehner, Max-Planck-Institut für Wissenschaftsgeschichte

In "The Present Situation in Quantum Mechanics," his 1935 response to the famous paper by Einstein, Podolsky and Rosen, Erwin Schrödinger coined the word "entanglement" (Verschränkung) to describe the impossibility of decomposing quantum mechanical states of composite systems. Einstein, Podolsky, and Rosen had exploited this formal property to argue that quantum mechanics is incomplete in its description of reality. Schrödinger rejected their conclusion, but he was the only one among the founding generation of quantum physicists to agree that they had pointed to a fundamental problem in the interpretation of quantum physics.

Schrödinger's research notebooks offer a rich and hitherto unused source about the prehistory of these two seminal papers. They show not only that Schrödinger had been long aware of the

ICHST
2017

phenomenon, already in 1926 he struggled with it as a problem for a physical interpretation of wave mechanics; they also document where Einstein got the original idea for the EPR thought experiment from, a question that so far only speculative answers have been given for.

Quantum Physics; Entanglement; Schrödinger; Einstein

Why Are We Surprised That Technology Drove Quantum Theory?: How the Reductionist Worldview Shaped the Historiography of Quantum Physics and What We Should Do about It

Joseph D. Martin, Consortium for History of Science, Technology, and Medicine

Scholars of nineteenth-century physics have drawn rich and numerous connections between the development of physical theory and the development of technology. Not only did advances in theoretical understanding of electromagnetism and thermodynamics enable new technologies, but the influence was mutual, and technical capabilities refined with little assistance from abstract physics often prompted new theoretical understanding. Little effort has been expended, however, in asking whether similar reciprocations can be identified in the history of quantum theory. This talk presents this historiographical oddity, proposes a reason for why it has persisted for so long, and argues that addressing its underlying causes can clear a path to a fuller historical understanding of quantum theory.

Recent scholarship has called traditional accounts of the development of quantum mechanics into question. Rather than being formed as a fundamental theoretical edifice, which was then applied to problems in other arenas, this work suggests, the essential architecture of quantum mechanics was elaborated in large part through efforts to make it useful for molecules, solids, and other complex systems. The recent broadening of historical perspective on the intellectual context that was relevant to the development of quantum theory suggests that further sustained study of its technological context would also be fruitful, and offer a perspective that represents continuity with the practices that defined late nineteenth-century physics.

Making this case presents an opportunity to reflect on why the historiography of quantum physics has for so long focused on one narrow set of conceptual factors to the exclusion of much else that historians have identified as relevant for the elaboration of other notable physical theories. This talk will explain that tendency in terms of the reductionist ideology that emerged in the high energy physics community in the 1960s, and which colored much early historical work on quantum physics. This “quantum fundamentalism” arose from a disdain for applications that was characteristic of high energy and particle physics during the Cold War. I argue that this fundamentalism has been accepted uncritically in many histories of quantum theory and that reevaluating the assumptions underlying it is prerequisite to a fuller understanding of the theory’s history.

Quantum theory; technology; reductionism; historiography

Revolution as a pedagogical problem: Boris Hessen and the historicity of modern physics

Karl Hall, Central European University

Boris Hessen enjoys a curious place in the Anglophone lore of the history of science profession. At the Second International Congress for History of Science in London in 1931 a Soviet delegation headed by Nikolai Bukharin famously proclaimed the many virtues of Soviet scientific research, but

only Hessen offered a historical lecture, on the socioeconomic roots of Newton's Principia. I propose to relocate Hessen's historicist scholarship within the changing physics curriculum at Moscow State University, where the nascent distinction between classical and modern physics was not yet firmly established in 1917. Theorist Igor Tamm was his frequent institutional ally in reforming the Moscow curriculum, and at the time of the London congress they were in the midst of a concerted effort to make quantum physics more central to physics training. How they eventually diverged, and why Tamm was ambivalent about his Nobel Prizewinning classical explanation of the Cherenkov effect, forms the heart of my story. The point is to show that Hessen's treatment of Newton was more than a proxy for Einstein and Bohr and the philosophical problems engendered by modern physics, but also a genuine attempt to retain a historical element in contemporary physics training.

Hessen Thesis; classical vs. modern physics; Igor Tamm; Cherenkov effect

The Formation of a Paper Tool: Intensity Schemes in the Old Quantum Theory (1923--1926)

Martin Jähnert, Max Planck Institute for the History of Science/Technical University Berlin

In a talk given in Cologne in 1924, Arnold Sommerfeld discussed the latest developments in multiplet spectroscopy. Photometric measurements conducted in Utrecht had put the problem of relative intensities on the map of quantum physical research, leading to a spur of research in Utrecht, Leiden, and Munich. In light of the advances already made, Sommerfeld was enthusiastic about a theory of intensities to be developed in the near future, which would extend the empirical scope of quantum theory considerably. Sommerfeld's high hopes for such a new theory did not rest on an extensive theoretical framework nor a grand physical assumption for a new quantum theory of radiation. Rather they were founded on so-called intensity schemes, tables constructed and manipulated according to a set of rules within his search for empirical regularities in multiplet spectra. Following the work of the historian of science Ursula Klein, I will analyze how these schemes emerged as devices for recording and analyzing experimental data and subsequently turned into a paper tool within Sommerfeld's approach to quantum physics. In addition, I will discuss the stabilization of the new tool and its interaction with another important research tool of the old quantum theory, the correspondence principle. This makes it possible to extend the recent discussion of Sommerfeld's *Gesetzmäßigkeiten* approach (Suman Seth) as well as to illustrate how conceptual development arose within the old quantum theory by means of the integration of different theoretical representations and associated practices.

Practice of Theory; Paper Tools; Quantum Theory; Arnold Sommerfeld; Correspondence Principle

Schooling the Quantum Generations: Textbooks and Quantum Cultures from 1900 to 1930s

Massimiliano Badino, Universitat Autònoma de Barcelona - MIT

Ever since Thomas Kuhn's influential *The Structure of Scientific Revolutions* (1962), textbooks have suffered a bad reputation. They have been accused to distort—at times unwaresly, at time purportedly—history and to feed students with an unacceptably simplified and optimistic view of science. This attitude has started to change only in recent times. With the increase of attention paid not only to how theories are conceived, but also how they are practiced, disseminated, and appropriated, historians have rehabilitated textbooks as a legitimate site of knowledge production.

Leaving aside their, admittedly problematic, relation with the cognitive dynamic of a theory, pedagogical practices have been now recognized as one of the prime historical reasons for the acceptance and development of formal procedures and paradigms.

More importantly, textbooks can become an effective historiographical tools to probe aspects of the cultural environment of a theory, which are usually opaque to purely intellectual investigations. In this paper, I adopt textbooks as an instrument to unfold multiple facets of the culture that allowed quantum physics to flourish between 1900 and the early 1930s. I organize this paper around four main keywords. The first keyword is time: textbooks allow us to see how the practice of quantum physics changed from the Old Quantum Theory to the inception of Quantum Mechanics. The second keyword is space: quantum physics was not developed in a crystalline outworld, but was situated in very specific local cultures. The third keyword is community: there is a strong tendency to consider the history of quantum physics as a business of a handful of genial men, while textbooks show us that the quantum community was much larger and stratified than commonly believed. Finally, the fourth keyword is tradition: from an analysis of textbooks it emerges that continuity, in terms of a continuous engagement of the traditions of physics, was more relevant than discontinuity.

Quantum Physics, Textbooks, History of Physics

On the physical reach and meaning of the setting-up of the “quantum mathematical formalism” in the historical and epistemological perspectives

Michel Paty, Laboratoire SPHERE, CNRS (Centre National de la Recherche Scientifique) & Université Paris 7-Diderot, Paris

This work deals with the question of the conceptual and theoretical jump that appeared necessary and was performed (in the years 1925–1932) to overcome the limitations of classical physics met with in the domain of quantum phenomena: such a jump is to be diagnosed behind the choice by the quantum theoretical physicists of what used to be called a “quantum formalism”. This naming itself, contrasted with the previous claims regarding the need for a new “quantum physical theory”, as expressed by Einstein and Born in the early 1920s, illustrates the perplexity that prevailed at that time among physicists about the physical status of such abstract mathematical tools that revealed exceptionally efficient in dealing with observed or inferred physical phenomena at the atomic (and subatomic) level. The “formalism” provided mathematical relations that proved adequate for the derived quantities accessible to experiment.

Notwithstanding the obscurity of its epistemological status, this new “formalization” of the theoretical thinking would continue to be extremely fruitful in the progressive elaboration and characterization of the theoretical magnitudes that showed adequate in the further unveiling of the quantum domain. The familiarization gained with it (from the 1930s to nowadays) by physicists through its systematic and successful use when dealing with quantum phenomena led them to think of it effectively as a “physical theory” in its own right. For they were affording (at least implicitly) to the mathematical entities at play (“magnitudes” that were not numbers anymore but operators) the effective role of concepts, whose physical meaning or content was given through the system of their relations, in other words, through the theoretical structure. In this, the so-called “formalism” did not differ in practice from “theory” in its usual and accepted previous meaning.

The most effective change that has occurred with the quantum theory, with respect to classical theories, including relativity, is in the kind and form of the proper quantum concepts (their form is that of operators). Such has been the result of the “jump in thought” that gave precedence, in the first stage of the formulation, to mathematical thought over the immediate physical one, in order to obtain a kind of relationships that were foreseen for physical reasons, but impossible to get classically.

We shall conclude by proposing a parallel with Einstein’s strategy towards general relativity.

Change (conceptual and theoretical); Jump of the theoretical thought; Mathematical formalism; Quantum physics; Relations between mathematics and physics

Yoshikatsu Sugiura's contribution to the import and development of quantum physics in Japan

Michiyo Nakane, Seijo University

Shin'ichiro Tomonaga (the Nobel Prize winner in 1965) recalls that Yoshio Nishina and Yoshikatsu Sugiura, two researchers at the Institute of Physical and Chemical Research in Tokyo, played key roles in the import of quantum mechanics to Japan. In contrast to Nishina, we have few historical works on Sugiura. However, during his stay in Copenhagen and Göttingen in 1924–1927, Sugiura published five papers on quantum mechanics involving the complement of the theory formulated by Heitler and London in 1927, which shows that two hydrogen atoms are bonded through the sharing of a pair of electrons. In April 1928, after returning to Japan, Sugiura delivered lectures about the latest discoveries and developments in quantum mechanics happening in Europe. Evidently, Japanese physicists had tried to keep up with the most recent advancements in this field, and they had read and reviewed the works of Dirac, de Broglie, Schrödinger, Heisenberg, and Born. Yet their exposure to the works of European scientists was limited because of their restricted direct personal contact to Western physicists. By attending Sugiura's lectures, however, Japanese physicists developed a more comprehensive understanding of the subject.

Sugiura shared his experience in Europe with his Japanese colleagues. He also helped Sommerfeld (1928), Heisenberg (1929), Dirac (1929/1935) and Bohr (1937) during their stays in Japan. In 1930, Sugiura also gave lectures on an application of quantum mechanics at the University of Kyoto, where Tomonaga and Hideki Yukawa (the Nobel Prize winner in 1949) had attended. However, since Sugiura talked about his original analysis of recent papers published in the field of quantum mechanics, his lectures were too difficult to understand for young scientists who had just finished undergraduate physics courses. In contrast, when Nishina explained Heisenberg's Physical Principles of Quantum Theory in his course in Kyoto in 1931, since the textbook he used was so appropriate for younger physicists, his lectures were quite attractive to them. This is one of the main reasons that Nishina succeeded in gathering many promising physicists, who later celebrated him as their teacher. Unlike Nishina, Sugiura had few students who became influential scientists, but he still was of the essence in helping to bring about the import and development of quantum mechanics in Japan.

*lectures on quantum mechanics in Japan; application of quantum mechanics; Yoshio Nishina
Japanese translation of European articles on quantum mechanics*

On the legacy of a notable quantum dissident: David Bohm (1917-1992)

Olival Freire Junior, Universidade Federal da Bahia

The flourishing of the research on the foundations of quantum theory at the end of the 20th century was a job performed by quantum dissidents. In this talk I intend to focus on the history of one of these notable dissidents, David Bohm, trying to assess his legacy to physics. Bohm's earliest work on plasmas and collective coordinates made his reputation. However, his most original and heterodox contribution to physics may have been the elaboration of the causal interpretation of quantum physics, published in 1952, which strongly departed from the standard theory in its conceptual and philosophical assumptions but still got the same predictions, thus opening the way for alternative interpretations of quantum mechanics. In the late 1950s, Yakir Aharonov and Bohm with their seminal

paper contributed to our understanding of the role of phases and electromagnetic potentials in the quantum domain. Later on, Bohm moved to the highly mathematical approach called implicit order, working with Basil Hiley, looking for the most basic algebraic structures from which quantum theories could emerge. He spent his last years trying to reconcile his different approaches to the quantum. Bohm's personal life carried the traces of the vicissitudes of the times. Caught in the American anticommunist hysteria, he left the US for a job in Brazil, later went to Israel and eventually the United Kingdom. He had his passport apprehended and lost his American citizenship, thus becoming the most notable expatriate American scientist. In the late 1950s he broke up ideological ties with Marxism and approached Eastern thinkers, becoming an iconic figure in the New Age culture of the 1960s and 1970s. Recognition for his outstanding contributions came later, as noted by his longtime friend Melba Phillips: "It is too bad, very sad indeed, that he did not live to see how his reputation has shot up recently." John Bell's later recollections about how he was driven to the research leading to what we know as Bell's theorem encapsulates this recognition: "In 1952 I saw the impossible done," referring to the appearance of the causal interpretation which was considered by contemporary wisdom as an impossible feat. Considering the diversity of culture of dissent, how could we assess Bohm's legacy for quantum physics? Rather than by one specific and lasting contribution, I think he should be acknowledged by his attitude pointing to the relevance of the research on the foundations of this theory.

quantum theory; David Bohm; history of physics

A third way to quantum measurement: Lev Landau and Rudolf Peierls' theory of measurement (1930-1958)

Reinaldo Faria de Melo e Souza, Federal University of Rio de Janeiro

The measurement process is one of the most prolific and controversial topics in quantum mechanics. It still remains on the forefront of research on quantum theory, more than a hundred years after the beginning of that theory. Historians and philosophers of science generally recognize two early schools of thought: one centered on Niels Bohr—the co-called Copenhagen Interpretation—, which attributed a key role to the principle of complementarity and to the uncertainty principle; and another centered on John von Neumann, who introduced the idea of wavefunction collapse as the essential aspect of quantum measurement. While the former was repeatedly blamed for being too philosophical, the latter was regarded as too mathematical. During the 1960s and 1970s, when the research on the foundations of quantum mechanics flourished, the young physicists were battling against those two schools, seeking for a more physical approach. In this talk I analyze a third approach—that was contemporary to those two—led by Lev Landau, which counterposes them by being indisputably physical. Landau's ideas were originally presented in an article written with Rudolf Peierls (Z.Physik, 69, 56 (1931)). While strongly influenced by Bohr, Landau and Peierls' treatment contains many distinctive features, both technically and conceptually. Later, that 1931 article served as basis for the first chapters of Landau's famous quantum mechanics textbook, published in Russian in 1948 and translated into English in 1958. I show that some of Landau's ideas were rediscovered during the 20th century and are related to what nowadays form the core of contemporary approaches to quantum measurement—namely, decoherence, relative-states, and quantum non-demolition measurement. Some aspects of these concepts were fully appreciated by Landau.

Theory of measure in quantum mechanics; Landau and Peierl's theory; Wave function and measurement

The self-accelerating electron: Dirac and Ashauer's Covariant Formalism

Silvio Renato Dahmen, Universidade Federal do Rio Grande do Sul

Sandra Denise Prado, Universidade Federal do Rio Grande do Sul

Emerson Gustavo de Souza Luna, Universidade Federal do Rio Grande do Sul

Sonja Ashauer (1923 – 1948) was a first-generation Brazilian physicist, the first Brazilian woman to earn a doctorate in physics and the second to become a physics graduate. As part of a generation of talented undergraduate students, she was granted a scholarship and moved to Newham College, Cambridge, where she got her PhD under the guidance of P. Dirac on the mathematical properties of solutions of the Abraham-Lorentz-Dirac-Equation for an accelerated electrical charge coupled to its own electromagnetic field. Her thesis actually consisted of two separate problems, somewhat related, the second being that of a generalization of the method of separating longitudinal and transverse waves in electrodynamics using Dirac's Hamiltonian formalism of 1932. In this contribution we will discuss the impact of Ashauer's thesis on the works that followed and how her untimely death at the age of 25 robbed the country of one of its most promising young physicists.

Self-accelerating electron, Covariant formalism, Abraham-Lorentz-Dirac Equation

The postwar fragmentation of quantum theory: Quantum cultures, epistemic virtues, and the meaning of the quantum

Thiago Hartz, Museu de Astronomia e Ciências Afins

The new generation of physicists picking up quantum physics just after World War II entered a discipline that started to fragment bit by bit into several subdisciplines that scarcely interacted with one another. In this talk, I will analyze the emergence of different schools of research within theoretical quantum physics between 1945 and 1975, paying particular attention to the following subdisciplines: quantum field theory, mathematical physics, quantum gravity, quantum optics, foundations of quantum mechanics, low-energy quantum electrodynamics, and particle physics. Physicists from these subdisciplines often dealt with similar problems, but from different perspectives and apparently without much interaction. For instance: What does it mean to “quantize” a classical system? Should all systems be quantized? What is an elementary particle? What are the roles of symmetry and of measurement in quantum physics? In which way are possible quantum theories constrained by experiment, or by mathematics? Are renormalization methods acceptable? Can quantum mechanics be reconciled with scientific realism, and perhaps even with determinism?

By looking at how the different subdisciplines answered similar questions, I aim at identifying their epistemic virtues as well as the role they attributed to mathematics and to experimentation in theory building. I will also explore how local specificities affected the emergence and consolidation of subdisciplines, and how physicists erected, policed, or subverted their boundaries. To illustrate my case, I will systematically draw on historical examples from works of other historians—in particular those attending the symposium—as well as from my own research. I will conclude with a discussion on whether the characteristic differences I observe between these various subdisciplines allow us to identify them as separate quantum “cultures.”

20th century; History of Physics; Quantum Cultures; Quantum Field Theory; Epistemic Virtues

The genesis of the causal interpretation of quantum mechanics: from priority dispute to class collaboration

Virgile Besson, Université Claude Bernard Lyon 1 - Universidade Federal da Bahia

The causal interpretation is well known for being one of the main alternatives to the standard interpretation of quantum mechanics. From 1952 until the mid-1960s, David Bohm and a group of French physicists in Paris around Louis de Broglie and his young assistant Jean-Pierre Vigi r collaborated in the development of the interpretation. The purpose of this presentation is to return to the genesis of this collaboration.

De Broglie was one of the main advocates of the probabilistic interpretation of quantum mechanics in France. He seemed to definitely have abandoned any attempt to describe the quantum world in a deterministic way since 1927, after the failure of his pilot wave theory, of which Bohm's 1952 hidden variable theory is an improved version. However, in the space of a few months, between the reception of Bohm's preprint in the summer of 1951 and the end of 1952, he reconsidered his opinion and decided to go back to his old idea. More surprisingly, de Broglie exclusively surrounded himself with Marxist physicists, even though he belonged to an aristocratic lineage and had never expressed any sympathy for communism.

In his later writings, de Broglie related that he was convinced both by the theoretical improvements proposed by Bohm and by a suggestion made by Vigi r according to which the theory could be reformulated within the framework of general relativity, opening up new unexpected perspectives regarding the unification of quanta and gravitation. This account is often taken up by historians whose approach mainly focuses on theoretical contents. The collaboration between de Broglie and the communists should therefore be understood as the result of a rational discussion between scientists, whose philosophies share in common a realistic standpoint.

However, I will show, based on the correspondence between the different actors, that this collaboration was the product of an alliance of circumstances, guided by strategic interests of the different parties. Bohm and de Broglie considered one another as opponents, because of an obvious priority dispute. The French communists needed de Broglie, even though they shared the distrust of Bohm and considered him a class enemy. For these young physicists, de Broglie's support would be a major help in order to obtain scientific legitimacy and credit. In the 1950s, the French Nobel prize winner was still a main figure in the scientific landscape with a privileged institutional position.

History of Quantum Mechanics; Science and Politics; History of Science in France; Louis de Broglie

015. Gender and Scientific Research: New Public Management in Higher Education or How to Take two Steps Back

The Limits of "Inclusion": Women-in-Science as Taxonomy and Consolation

Amy Slaton, Drexel University

Throughout the history of inclusive educational and employment programming, intended since roughly the 1970s to bring more women into more scientific fields, American institutions have constantly reified gender binaries and undertaken other essentializing taxonomic projects. How can we best expose the limited emancipatory impacts of familiar gender-inclusive science programming and picture other avenues for change? Those identified or self-identifying as women, like "persons of color," "disabled people," and other communities long marginalized in U.S. science education and hiring, have unquestionably experienced profound inequities at every juncture. The Civil Rights era interrupted this pattern but did not dislodge it. So-called diversity programming seems to demand that women be granted entry into place of scientific education and work, but diversity is by definition

predicated on taxonomic mixing: it functions primarily to reproduce the idea that knowing one another as belonging to a particular gender is not only vital to our social functionality, but inevitable. In this way, the consoling impulse of welcoming those traditionally excluded from one's world is also fostered; those on the inside can reassure themselves that the inside and its boundaries will be preserved even as they let selected others in.

Adding third, fourth or further genders to the diversification process does little to change these essentially conservative conditions within scientific sectors. Certainly this approach has not laid the groundwork for effective democratic action in the face of resurgent sexism today; we might in fact wonder about the level and kind of change actually intended in those earlier periods. As well, we might alternatively imagine that redistributions of opportunity in science learning and labor could derive from structural changes: Challenges to the deeply uneven systems of public education; profoundly inequitable wage systems; and hierarchical social systems in which American universities and employers operate. In this way we might shed light on the emergent conditions discouraging authentic redistributions of representation in global scientific settings, as well.

Gender, Diversity, Inclusion

016. Family, Science, Technology, and Medicine: Gender in Local and Global Perspective

Summer Retreats, Travel, and Family in the Scientific Life of František Lexa (1876–1960), the first Czechoslovakian Egyptologist

Adela Junova Mackova, Masaryk Institute and Archives of the Academy of Sciences, Prague

In my paper I will explore the family and the family milieu of the first Czechoslovakian Egyptologist František Lexa, founder and first director of the Czechoslovakian Institute of Egyptology, expert on Egyptian philology, especially demotic languages, and mentor of two important Egyptologists, Jaroslav Cerný, professor at Oxford University, and Zbynek Žába, professor at Charles University, Prague. I will analyse the social status of Lexa's family and the importance of his marriage in shaping his scientific life. I will consider the everyday routines of this scientist's household, including the claims demanded by the requirements of bringing up three children. As a specific focus, I will analyse the everyday life of a travelling scientist, particularly during holidays spent with family abroad, and illuminate the significance of summer retreats in shaping a scientists' familial travel experience.

family; gender; Egyptology; science

Domesticity in the Making of Scientific Careers: Agnes Pockels (1862-1935) and Lord Rayleigh (1842-1919)

Donald Luke Opitz, DePaul University
Brigitte Van Tiggelen, Chemical Heritage Foundation

In the late nineteenth century, domesticity in Western science was both transformed and redeployed. In European, British, and American contexts in which the institutionalization of scientific research outside of the home widened the "separation of spheres," cultural tropes of masculinity and femininity also positioned male and female labor on each side of the domestic threshold, respectively outside and inside. Although this separation tended to result in the reduction and

circumscription of women's roles in the sciences, this pattern did not always hold, and domesticity could be leveraged in ways that actually expanded women's roles. In this paper, we examine one such case, that of the independent chemist, Agnes Pockels, known for her pioneering work on surface tension. Working exclusively within the context of her home, but receiving the assistance of male collaborators both in Germany and abroad, Pockels achieved significant experimental results that indeed won her renown both in Germany and internationally. Critical to her successes was the help of British physicist, John William Strutt, third Baron Rayleigh, in promoting the publication, and thus visibility, of her otherwise neglected work. Although historians have analyzed this case before, here we focus on the familial dimensions to their collegiality and how domesticity itself provided both the infrastructure, social matrix, and moral norms enabling a productive, cross-gender, transnational collaboration. We shall comparatively explore the German and British sides to this case, and offer how domesticity may serve as a useful analytical tool for exploring the dynamical relationship between gender, family, and science.

domesticity, family, gender, physics

Reforming society: female improvers in late eighteenth-century

Elena Serrano, MPIWG-Berlin

As has been shown by Lorraine Daston and others, the most pervasive topic during the long eighteenth-century in western shaped economies was that knowledge needed to be "useful." Scholars have investigated how the rhetoric of usefulness served different purposes, from securing royal funds, to backing careers, to supporting a thriving market of scientific objects and spectacles, to setting up scientific and economic societies. More recently, Mary Terrall has argued that "useful" defined science with values of masculinity. Useful opposed frivolous, flighty, and whimsical, adjectives recurrently applied to women, and specially on how women approached science. My paper argues that along with the broad mobilization of male improvers, women also publically engaged in making useful science. Femininity was also constructed through the making of useful knowledge, especially in household economies and in institutions moulded on them, such as hospitals and foundling houses. Moreover, presumably feminine sensibilities, charitable feelings, and domestic attachments were used to advantage by women to intervene in knowledge making, both in domestic and public settings.

I will focus on the female branch of Madrid Economic Society, the Junta de Damas de Honor y Mérito (Ladies of Honour and Merit Committee). My aim is three-fold. Firstly, the paper shows how the Junta embodied a femininity in which knowledge played a major role. The learned and highbred women of the Junta incarnated the ideal of the female improver, or how upper-class women should involve in the moral and economic reform of society. Although the male improver is a well-known character in the history of knowledge, the female improver has received scant attention. Through the analysis of the ways in which the Junta women claimed to be more suitable than men for certain activities, I explore the role knowledge had in the articulation of a novel upper-class femininity. Secondly, the paper shows how with the aim of reducing the high mortality rates, the Junta applied gendered ideas on the governance of households to the governance of Madrid foundling house. Finally, it stresses the socio-political Spanish circumstances that made possible setting up such an exceptional institution and how the Junta extended its network to the Spanish regions and abroad.

Gender, Improver, Femininity, household, oeconomy

Women in 17th and early 18th century private Natural History: the Salvador family in Barcelona

Emma Sallent Del Colombo, Universitat de Barcelona

The Salvador family belonged to the profession of apothecaries, who in the early modern period actively engaged in the study of nature. Shops of apothecaries were not only places for the preparation and selling of drugs, but also the spaces in which the owners met with physicians, surgeons, naturalists, herb collectors and other curious patrons to examine, identify, and analyze natural objects, discovering their properties and therapeutic effects.

The Salvadors in particular assembled a cabinet of curiosities, from the seventeenth century on, in Barcelona that has survived to this day, owing to a series of very interesting and fatal vicissitudes. In my research, I seek to illuminate the following aspects of the pursuit of natural history by Spanish apothecaries like the Salvadors in the seventeenth century: the circulation of natural history knowledge among the network of agents within and beyond Europe, and their connections with traders and merchants among whom information and goods, materia medica and other natural objects. I am also interested in exploring the practice of natural history with different spaces of sociability, especially salons and reboticas, and the distinctive roles played by the different medical professions (physicians, surgeons, apothecaries), especially their social positions and evolution in a local and comparative framework.

Within this project, I ask in particular: where were the female practitioners? Was there a feminine natural history? In which ways was this science gendered? In pursuit of these questions, I will explore the gendered dimensions of the research by considering the private and public spheres, writing practices in apothecaries, and the importance of family affairs. This orientation to the subject exposes the importance of women's roles in marital strategies to preserve professions and family interests, in supplying contacts and commercial relationships, and in contributing to private spaces of knowledge production.

By relying on an "indiciary paradigm," inspired in Carlo Ginzburg's microhistory, and by analyzing the materials preserved in the Salvador Collection at the Botanical Institute in Barcelona, I will build the Salvador family as a case that demonstrates the interplay of local and global connections in the history of science.

Salvador family; Barcelona; Natural History Collections; Apothecaries; Women

Drosophila's families of geneticists

Marta Velasco-Martin, Instituto de Filosofía, CSIC

On July 1933 the geneticist Natasha Sivertzeva-Dobzhansky received a letter from her colleague Lilian Vaughan Morgan, also a geneticist. Both women were working as independent researchers in a laboratory of the California Institute of Technology in Pasadena, in the same institution as their husbands, Theodosius Dobzhansky, assistant professor, and Thomas Hunt Morgan, director of the William G. Kerckhoff Laboratories of the Biological Sciences. Lilian Morgan's letter congratulated Natasha Dobzhansky for her recent maternity after having a girl named Sophie on 13th July, also the day on which Lilian Morgan celebrated her own birthday. The day after, on 14th July of the same year, Thomas Morgan also wrote a letter to Theodosius Dobzhansky to congratulate him on his fatherhood. Both letters, preserved in the American Philosophical Society's Archives as part of the Theodosius Dobzhansky Papers, document Sophie Dobzhansky's entry into a scientific community, that of her parents. She not only was part of the Dobzhansky family but also of the scientific unit initially run by her parents who worked together throughout their lives.

In 1951, 1952 and 1955 the three children of the geneticists of *Drosophila's* populations, María Monclús and Antonio Prevosti, were born in Spain. As Sophie Dobzhansky, Marta, Antoni and Eugeni

ICHST
2017

Prevosti Monclús also came to the scientific unit run by their parents in the late 1940s when they met in the University of Barcelona and began working together. The children of these two couples of geneticists eventually participated in the researches they conducted through their home countries and others, capturing flies in the field and contributing to the activities that harness its power. This paper deals with *Drosophila* genetics that was co-produced in the local context of the researches conducted in family and in the transnational context of a scientific style carried out by sharing with other colleagues the research activity of family endeavors as male products. Scientific papers, congresses, conferences and international research journeys take part in a story that shows scientific knowledge production as the result of a shared creativity and intimacy, a work conducted in places outside laboratories, in field stations and households. By exploring familial communities I retrieve agents usually hidden in many narratives: women and children.

Drosophila; Genetics; Family

Social strategies of scientists' families in Central Europe in the 19th century

Milada Sekyrkova, Charles University in Prague

During the long 19th century, networks of scientific families formed in Central Europe, producing several successive generations of influential figures in the natural sciences and humanities. At the same time, families strategized to maintain their stability and status among a broad intelligensia of the Central European region. This paper explores the role of such factors as locality, education, and marriage in shaping the experiences and strategies of the Hrdlička, Frič and Heyrovský families. Among the Hrdlička family was Aleš Hrdlička (1869–1943), the first curator of physical anthropology of the Smithsonian Institution's National Museum of Natural History in the U.S. From the very distinguished Prague family, Frič sprung Antonín Frič (1832–1913), professor of zoology and paleontology of Charles University, and the botanist, traveler and writer Alberto Vojtěch Frič (1882–1944), and others. Jaroslav Herovský (1890–1967) won the Nobel Prize for chemistry in 1959. His father Leopold was professor of Roman Law at Charles University, and relatives were related to historian and politician František Palacký. Jaroslav's brother Leopold, educated as a lawyer, became a famous entomologist.

By analysing these three scientific families, with their different backgrounds and positions within the Central European scientific network, we can better appreciate the varied ways by which family units can function to provide individual career strategies as well as promote intergenerational traditions within scientific networks.

scientific networks - Central Europe - 19th century - family strategies - history of science

017. Technologies and the formation of early civilization in China: a global perspective

Fusing Technologies and Arts in the History

Fude Tie, National Museum of China
Junhua Long, Capital Museum, China

Cultural heritage is valued from there nature of combination of history, arts and science and technology. The research to cultural relics then should cover difference perspectives from these three dimensions. We argue for a deep understanding of the research on the field of cultural

heritage, which is rooted from the history and expanding its consideration to the arts with special emphasis on the science and technology as well. This help us to be more conscious of the research of cultural heritage, especially from a conservation perspective in a multi-discipline thinking.

Cultural heritage; multi-discipline; science and technology

Bronze Metallurgy and Society in Bronze Age China

J. Mei, The Needham Research Institute

Over the past two decades, with considerable new archaeological evidence from Northwest China and Central Plains of China, it has become increasingly clear that copper and bronze metallurgy was first introduced into northwestern China from the Eurasian steppe and then spread further eastwards to Central China during the third millennium BC. The appearance of ritual bronzes and the rise of piece-mould casting technology at the Erlitou site in Henan province marked a breakthrough in the early development of bronze metallurgy in Central China during the first half of the second millennium BC. The subsequent Shang dynasty witnessed a diverse development of bronze technologies in many regional centers, indicating the significance of regional interaction as well as local innovations. This paper aims to offer an examination of the relationship between bronze metallurgy and society in Bronze Age China in the light of recent archaeological discoveries. It is argued that the adoption of bronze technology into an existing ritual practice could have lead to the institutionalized production of ritual bronze vessels and weapons. It was through the control and development of the production of bronze ritual vessels that the Shang and Zhou kings as well as the smaller kings of many states or major noble families might have consolidated and strengthened their political power or influences. The organization and control of the production of bronze metallurgy in the Shang and Zhou periods already seem to have displayed some of characteristics of early Chinese civilization, such as a highly institutionalized craft production, centralized control, mass production, and persistence of an established tradition.

Metallurgy; Bronze Age; China; society

Formation of the “Five Cereals” agricultural tradition in Northern China

Juzhong Zhang, University of Science and Technology of China

Rice farming and dry farming formed gradually in South and North China respectively since last 10,000 years, and corresponding to this situation, peoples' lives in these two regions were characteristic of 'Rice Recipe and Fish Soup' (Daofan'gengyu) and 'Bumper Grain Harvest' (Wugufengdeng). Based on Chinese ancient documents, "Five Cereal" agricultural tradition, a mixed farming of foxtail millet (*Setaria italica*), broomcorn millet (*Panicum miliaceum*), rice (*Oryza. sativa*), wheat (*Triticum aestivum*) and soybean (*Gycin emax*) had formed as early as the pre-Qin periods 4000 years ago in Central and North China. However, little work has been reported about the spatial and temporal forming process of this mixed farming. This paper mainly discusses the forming process of Chinese "Five Cereals" farming in North China based on new researches from archaeobotany, agricultural archaeology and environmental archaeology carried out in recent years.

Many research results of macro and micro-plants, and pale-environment analysis conducted in the regions north to the Yellow River Valley demonstrated that dry farming represented by foxtail millet and broomcorn millet originated in some early Neolithic sites dating back to around 10,000 years ago, including Donghulin site in Beijing, Nanzhuangtou site in Hebei Province, and Shizitan site in

Shanxi Province. Till 7,800 a BP, a mixed farming of rice and millet had appeared in the Huang-Huai plain, central China, and this mixed agriculture finally dominated in human subsistence pattern in the later period of Yangshao era during 6000 and 5000 BP. In the age of Longshan era since 4300 a BP, the cultivation of wheat, originated in West Asia region became prevalent in this region. Meanwhile, soybean with domestication characteristics also emerged in the north China which had been utilized as early as nearly 9000BP. By this time, the mixed farming of foxtail millet, broomcorn millet, rice, wheat and soybean called the “Five Cereals” eventually formed in the middle reach of Yellow River and upper reach of Huai River during the late Longshan period and early Xia Dynasty, which laid the economic foundation to the formation and preliminary development of Chinese Civilization.

five cereals; agricultural archaeology; Northern China

Cross-cultural Interaction of Shang Dynasty: An Archaeo-metallurgical Perspective

Kunlong Chen, University of Science and Technology Beijing
Jianjun Mei, Needham Research Institute, Cambridge

The regional features of Shang period bronzes had been noticed since middle of last century and then became an outstanding hot topic with continuous significant discoveries from the so called “peripheral areas” surrounding the Central Plain. Among these areas, there are several geographically separated and culturally different units, namely Sanxingdui, Xingan, Guanzhong Plain and Hanzhong Basin where numerous Shang period bronzes have been found, showing both likeness and unlikeness. Archaeo-metallurgical studies reveal that a considerable number of artifacts have plausible various and intricate cultural or technical elements despite of their homogeneous labels such as “Shang-style” or “Local” objects assigned by previous research quite frequently only based in artistic and art historic criteria. Therefore, in this paper we emphasize looking at the production stages by the scientific analyses and technical investigation of the bronze items to explore a further understanding on the technical-cultural exchanges between different regions.

Bronze Age; China; Metallurgy; Regional interaction

Manufacturing techniques and Corrosion mechanism analysis on Nanzhao Iron Post

Li Xiaocen, Nanjing University of Information Science and Technology

Nanzhao iron post in Midu County in Yunnan Province is studied in this paper. The Iron post was Nanzhao period legacy of metal artifacts dating back to 1100 history. For research into Nanzhao Iron post Manufacturing techniques and its surface of the corrosion mechanism, the authors did some fieldworks and experimental works. It is considered that the above ground part of iron post is casted by 7 molds of a one-time, using the erect-casting method, while how the underground part formed is uncertain. Metallographic observation shows that the material of Nanzhao iron post is Grey Cast Iron. SEM-EDS and XRD analysis of the surface samples of iron post indicates that the raw materials of iron post consist of hematite(α -Fe₂O₃), goethite(α -FeO(OH)), magnetite(Fe₃O₄), and a mixture of quartz. The surface of the iron post looks glossy and black, but it also can get rusty. It is just the compact rust layer of the surface that broke off the corrosion reaction.

Nanzhao iron post; Model casting; Grey cast iron; corrosion reaction

Cast Iron-smelting Furnace Materials in Imperial China: Macroobservation and Microscopic Study

Liu Haifeng, Nanjing University of Information Science and Technology

Field investigation was carried out to observe ancient cast iron smelting furnaces at 15 sites from Imperial China. Petrographic analyses were performed on furnace materials to study the development of metallurgical ceramics used on these furnaces. The results show that furnace materials developed from simple clay material to a composite structure made of stone and clay. During the period from the 4th C. BCE to the 3rd C. CE, rammed clay or stacked clay bricks were used to build the furnaces; from the 7th to the 13th C. CE, furnaces were predominantly made with a durable outer wall constructed from stone, while the refractory material that lined the inner surface of the stone wall was composed of clay, sand and gravel-sized rock fragments. In addition, this paper discusses some aspects of governmental organization, furnace and smelting technology, economics which might influence this development, and examines the relationship between ceramic technology and metallurgy in Imperial China.

Metallurgical ceramic; Refractory material; Cast iron; Smelting furnace

The chemical composition and manufacture process of the glass beads excavated along the Silk Road in Xinjiang

Rui Wen, Northwest University

The earliest glass beads emerged in China in the West Zhou dynasty and it declined after West Han and East Han dynasties. The materials of early glass beads include faience, frit and real glass, the faience and frit are primary stages of glass. The glass beads distributed broadly in China but the previous studies mainly focused on central part of China. Several important issues which include the spread process, spread route of glass beads and the manufacture interaction between China and western civilizations are still weak. This paper main focus on the glass beads which were excavated from the sites along the Silk Road in Xinjiang in the last few years. The LA-ICP-AES, EDXRF and LRS will be used to analyze the chemical compositions of the glass beads to identify the main body, the opacifier and the coloring aging of the glass beads; the SR- μ CT will be used to analyze the microstructure of the glass beads, meanwhile, the model for correspondence between the manufacture process and microstructure will be set up through the simulation experiments. The manufacture process of ancient glass beads will be revealed based on these analysis; The XAFS will be used to study the coloration mechanism. Based on these results, the glass beads from different areas and different types glass beads were compared. The paper made significant contribution to the issue of the origin of the glass making in China, furthermore, it had remarkable meaning to understand the spread of the glass beads and the interaction of the manufacture process between different civilizations.

glass beads; chemical composition; manufacture process

The Shang bronze casting foundry in Taijiasi: technology, provenance and their archaeological implications

Siran Liu, University of Science and Technology Beijing

Xiaolin He, Wuhan University

Jianli Chen, Peking University

Shijia Guo, Peking University

The bronze casting craft was traditionally thought to be closely associated with the central capital sites such as Zhengzhou and Anyang, which allowed the Shang Kings to control the distribution of ritual vessels. However, the find of bronze casting moulds for ritual vessels and copper processing remains at the site of Taijiasi in the middle range of Huai River shed new light on this discussion. The site is dated between the Upper Erligang period and the third stage of Yin Xu period while the metallurgical activities mostly concentrated in the first stage of the Yin Xu period (14th-13th century BC). During this period, the site is tentatively explained as a regional centre controlling the adjacent agricultural land and potentially the trading routes between Anyang and Wannan (皖南) area in the Yangtze River valley.

This paper reports the result of *insitu* pXRF survey and lab-based analysis of several types of casting remains and features. It seems that people at Taijiasi had a rather complete *chaîne opératoire* for bronze manufacturing from refining raw copper, alloying copper with tin to casting objects with highly sophisticated piece-mould method. The casting foundry was covered with a thick layer lime produced by roasting local calcareous nodules in order to prevent the influence from ground moisture.

Lead isotope analysis of bronze objects, casting slag, and furnace lining shows that copper and lead used at this site both contain highly radiogenic lead, which, though commonly found in the Shang bronze artefacts, could not be matched with any geological copper-lead deposit in China. It can only be suggested that the site of Taijiasi was within a vast metal circulation system controlled by the Shang central power.

The find of bronze casting foundry in Taijiasi urges us to rethink the Shang bronze distribution system. Metal resources e.g. raw copper and tin (or cassiterite) were brought to this site from various origins and manufactured into ritual vessels with a typical Central Plain technical tradition. It might suggest the Shang central power had managed the flow of raw materials and skilled craftsmen rather than finished objects themselves.

Shang; bronze casting; lead isotope

The Philosophy of the Early Cast Iron Smelting

Wei Qian, University of Science and Technology Beijing

The history of cast iron informs us that the technology development might happen in an open social context so that the technical knowledge could be produced and transmitted widely. The cast iron smelting invention is an example of high harmonious and systemic technical thought in ancient China. The inherent culture of Chinese technology of *he* (harmonious) led the special way to develop cast iron technology which was quite different to the West. It can be argued that the invention of cast iron is one consequence of a distinct philosophical approach to technology that started in the Western Zhou Dynasty (1046-771BC) and was fully developed in the Eastern Zhou Dynasty (770-256BC), when a variety of philosophers such as Confucius flourished. The technical thought was so different from that of the West that they developed two opposite systems of iron smelting and making methods: casting, decarburising and annealing in China; bloomery, carburising and forging in the West. The philosophical approach focussed on the inter-relationships of system over its structural analysis and the details of the component parts. A potential analogy can be seen in the

contemporary inventions of cast iron smelting and medical techniques in China. The operators could decide the exact treatment through the changes of flash and slag, just like the doctors could do through the facial changes in the human body. They all believed the inner relations in one system, and paid more attention to the relations instead of the structure analysis and part details.

cast iron; philosophy of technology; history of metallurgy

Researching on ancient people's diet of some archaeological sites of Bronze Age in Xinjiang based on C&N isotopes analysis

Zhang Xuelian, Institute of Archaeology Chinese Academy of Social Sciences

Guo Wu, Institute of Archaeology Chinese Academy of Social Sciences

Wu Xinhua, Institute of Archaeology Chinese Academy of Social Sciences

Zhang Jun, Institute of Archaeology Chinese Academy of Social Sciences

Wang Minhui, Institute of Archaeology Chinese Academy of Social Sciences

For over ten years now, we have researched the ancient people's diet of some archaeological sites of Bronze Age in Xinjiang area based on isotope analysis of carbon-13 and nitrogen-15. From these results we have got some information of their diet at that time, which provides the basis for the research of the environment at that time.

ancient people's diet, isotope analysis of carbon-13 and nitrogen-15, Bronze Age, Xinjiang area

018. Mathematics and mathematics education in East- and Southeast Asia in pre-colonial and colonial eras

Visual Representations of Computational Instruments in Traditional Mathematics Education of East Asia

Alexei Volkov, National Tsing-Hua University

The paper is devoted to visual representations of two counting instruments, the counting rods (known as *suanzi* 算子 or *chousuan* 籌算 in China and *sangi* 算木 in Japan) and the abacus (Chinese *suanpan*, Japanese *soroban* 算盤), found in mathematical treatises compiled in East Asia prior to the advent of Western-style computational techniques. The former instrument was gradually replaced in China by the latter in the first half of the second millennium AD, but remained in use in Japan and Korea until the 19th century. The didactical function of the visual representations of these two instruments in mathematical treatises has not been given due attention by historians of mathematics education. The goal of the present paper is to offer a preliminary discussion on two categories of images found in mathematical texts: (1) those representing configurations of counting rods, and (2) those featuring positions of beads on an abacus in the course of computations. Diagrams of these types were arguably designed for educational purposes, and, most probably, were supposed to be used by the learners, yet it remains unknown whether the learners were supposed to reenact the operations described in the texts exactly as they were shown in the diagrams, or simple inspection of the provided diagrams would have sufficed; both options appear possible. It will be argued that, despite the conventional view, the diagrams showing counting rods can be found in Chinese mathematical texts produced as late as the mid-16th century, that is, at the time when, according to a number of authors, this instrument was generally replaced in China by the beads abacus (*suanpan*).

As for the diagrams representing configurations of beads on abacus, it will be argued that they became especially widely used only relatively late, while early mathematical manuals featuring abacus computation contained only descriptions of operations without providing depictions of the configurations of beads. This phenomenon may have reflected a considerable change in the didactical practices related to teaching arithmetic.

"traditional mathematics in East Asia"; "history of mathematics education in East Asia"; "history of computational instruments"; "counting rods"; "beads abacus"

The textbooks on geometry in Meiji Japan (1868-1912): evidences of the revolutions of mathematics teaching and books

Marion Cousin, Lyons Institute of East Asian Studies

During the Meiji era, the political context in East Asia led the Japanese authorities to embark on a nationwide modernization program. This resulted in the introduction of Western mathematics and especially Euclidean geometry into Japanese education. However, as traditional mathematics (wasan 和算) were very successful at that time, there were no Japanese translations of texts dealing with this new geometry available at this time. In the meantime, the shape of Japanese books changed completely, as new Western printing methods were introduced in the country. For example, typography progressively replaced xylography and this had an influence on the way authors wrote mathematical texts. Moreover, the textbooks, their edition, their diffusion in schools and their use in the classroom evolved rapidly.

To contribute to this symposium, I will present several textbooks published during the second half of 19th century in order to draw a parallel between mathematics history and book history. I will show that these textbooks are the evidences of the book revolution that occurred during the Meiji era, regarding printing and binding techniques. But I will also show that the content of the textbooks itself was determined by this book revolution. We will ask how the textbook were written in this situation, how authorities controlled the content of geometry teaching and how these textbooks were actually used in geometry lessons.

History of mathematics in Japan; History of education; Printing and editing history

Traditional Mathematics of Mid-Eighteenth to Mid-Nineteenth Century Japan

Rosalie Hosking, University of Canterbury

During the Edo Period (1603-1868 CE), political motivations saw Japan close its borders and institute a period of isolation that would last over 200 years. During this time, the Japanese developed a unique style of mathematics known as wasan 和算. This traditional mathematics flourished until the mid-Nineteenth century, when Western mathematical texts entered the nation.

This paper looks at traditional problems of wasan from the period prior to the introduction of Western methods in the mid-Eighteenth to mid-Nineteenth centuries. Our aim is to illustrate the nature of the traditional tradition that existed at the time Western mathematics arrived on Japanese soil. We focus on typical mathematical problems of this era to illustrate the subject matter, structure, and methods Japanese mathematicians were most commonly investigating and adopting.

It is the case that many traditional problems of this time are absent of any working showing how the mathematician arrived at their solution. To help understand how these problems would have been traditionally solved, we also examine some rare instances where solutions are given to problems

using the *tenzan jutsu* 点竄術 symbolic manipulation technique developed by the Edo mathematician Seki Takakazu 関孝和 (? – 1708 CE). A selection of such solutions from the 1810 CE mathematical text *Sanpo Tenzan Shinan* 算法点竄指南 by Ohara Toshiaki 大原利明 (? – 1828 CE) are transliterated and translated into English.

Wasan; Edo Period; Tenzan Jutsu; Japanese; Algebra

History of Vietnamese mathematics education: from the treatises written in Han-Nom language to the mathematical manuals written in modern Vietnamese

Ta Duy Phuong, Hanoi Institute of Mathematics, Vietnam Academy of Science and Technology
NGUYEN Van Hong, Hai Phong University, Vietnam

In this paper we provide a brief overview of Vietnamese mathematics and mathematics education of the pre-colonial (from the 15th to the 19th century) and colonial (from 1859 to 1954) eras. Our presentation will begin with a short overview of the extant treatises written in classical Chinese (Han) and literary Vietnamese (Nom) languages both of which used ideographic script (Chinese characters or Vietnamese characters based on Chinese ones). Then we will briefly discuss the process of introduction of the mathematics education during the colonial era, when the approaches to didactics, the contents of the textbooks, and even the language of instruction changed dramatically being influenced by French mathematics education. We shall particularly focus on the didactical ideas of the educators reflected in the structure and contents of the mathematical manuals produced during both periods under consideration.

history of mathematics, history of mathematics education, history of traditional Vietnamese mathematics, Vietnamese mathematics during pre-colonial and colonial eras

Beads abacus: from counting instrument to didactical device

Viktor Freiman, Université de Moncton
Alex Volkov, National Tsing - Hua University, Taiwan

The beads abacus appeared in European, American, and Russian textbooks as educational device in the early 19th century. Two versions of the instrument drew special attention of the educators. The first one was divided into two sections containing beads representing different values (one and five); the Chinese *suanpan* and Japanese *soroban* belonged to this category. The second one was the Russian abacus (*schyoty*) with ten beads; each bead represented one unit. The origins of both instruments remain unclear. A number of European authors claimed that the Russian abacus originated from the Chinese one, while I. G. Spasskii in his work of 1952 advocated the hypothesis of the Russian origin of the *schyoty*.

The instrument gained a wide popularity in the late 18th and especially 19th century, when a number of educators in Western Europe, North America, and Russia started experimenting with various modifications of abacus in mathematics classroom. While the abaci in Western Europe and America were used exclusively in educational context, the Russian abacus remained widely used outside of school classroom for everyday calculations until the second half of the 20th century.

In our paper we briefly present the history of East-Asian and Russian abaci, of their “discovery” by mathematics educators, and of the attempts to introduce operations with the instrument into the school curriculum.

019. Understanding One Thousand Golden Drugs: Transformation of Pharmaceutical Practice from Pre-modern to Contemporary China

Bringing new drugs to the Chinese marketplace: The corporatization of academic research and the commodification of drug discovery in Hong Kong

Christine Yi Lai Luk, University of Hong Kong

The Chinese pharmaceutical business is a lucrative market force for not only global pharmaceutical companies but also academic biologists and clinical-trial researchers who serve as mediators between producers and consumers of new drugs. In Hong Kong, the changing governance of public universities towards privatization and corporatization has prompted academic researchers to generate income through engaging in entrepreneurial activities. The universities' quest for becoming entrepreneurial create a strong push for academic life scientists to create linkage with drug manufacturers and consumer markets. Academic biologists have become a crucial actor in drug discovery and development, not only as researchers for conducting laboratory research and clinical trials, but also as salesmen and developers through participating in a number of non-research activities that help pharmaceutical companies to identify and create new markets. This paper will examine the cultural politics of drug discovery in contemporary Hong Kong. The postcolonial biotech enterprise is shaped by a vigorous participation of business-savvy biomedical researchers who are keen on identifying new drugs for prevalent diseases such as cancers. Recognizing Hong Kong's aging population and the increasing cachet of medical culture, a handful of university life scientists strategically aligned their work with pharmaceutical companies, drug stores, and patients to bring new drugs to market. Using the production and promotion of the first homegrown anti-cancer drug, BCT-100, as a case in point, this study will illustrate how drug discovery have come to resemble other commodities in the booming Chinese drug marketplace.

Hong Kong, pharmaceutical, commercial, university, China

Exoticism Rationalization Admixture: Chinese Embryos and Drugs at the "Hopkins in Peking," 1922–1932

Lijing Jiang, Chemical Heritage Foundation

In the studies of biomedical material circulations in Republican China in general and at Peking Union Medical College (PUMC) in particular, scholars have often emphasized the processes of importation of medical instruments and analytical methods. This paper, through examining the material practice involved in collecting human embryos and drugs recorded in medical cannons at the PUMC between 1922 and 1932, reveals how amassed embryos and drugs within China not only attracted foreign scientists, but also compelled researchers to assume new research strategies and invent new theoretical apparatus. Particularly, the human embryo collection for studies of human evolution and eugenics at the Anatomy Department led by Edmund Vincent Cowdry prompted researchers to reconsider the Chinese race as having a special evolutionary path; while Bernard Read's translation and chemical analysis of drugs recorded in medical cannons demonstrated how reconsideration of the rationales of drug prescriptions in medical manuals inspired several designs of expedient chemical analysis for Chinese drugs. Although PUMC's embryo and human evolution studies have

ICHST
2017

since become a relic in the history of biology with the demise of eugenics, several of Read's methods had long-term impact in biochemical studies of what were understood later as TCM drugs.

TCM, Embryology, Peking Union Medical College

The Chinese Pharmaceutical Revolution: Pharmaceutical Crisis and the Reform of Chinese Drugs in Republican China

Liu Xiaomeng, The University of Hong Kong

This paper explores the new attempts to reform the Chinese pharmaceutical practice by applying mechanical and chemical intervention in republican China. Since 1910s, major deficiencies of Chinese drugs had been identified in terms of the absence of scientific research and the incompetence in the market competition with imported western drugs. An urgent situation of “Chinese pharmaceutical crisis” was proposed by contemporaries and different initiatives and actions were undertaken by different groups of people. This paper examines two mainstream approaches in republican period to renovate the Chinese pharmaceutical practices. The first was proposed by West and Japanese trained pharmacologists who keenly stressed the necessity to undertake rigorous scientific study of the traditional Chinese materia medica, which would finally lead to a universal standard for drug research and production making fully use of nationally produced material. The other was a more controversial yet pragmatic approach favored by industrialists to seek the possibility to reform the Chinese drug manufacture by imitating the modern technology applied by western drugs. Both of the two attempts called their own practice as “Chinese Pharmaceutical Revolution”, which further demonstrates the contested and tentative nature of republican pharmaceutical renovations. The transformation of Chinese pharmaceutical practices was not a coherent idea or practice in republican China, and throughout the process, the historical actors contested over the practice of reforming Chinese drugs, mobilized the public opinion, and created new visions of “Chinese pharmaceutical revolution”. Political instability, social changes, market forces, and nationalism were deeply embedded in the process, and the result of the “revolution” reached a compromise, though volatile and controversial, between the two systems of medicine, and between the scientific dream and the social reality, which continues to shape the pharmaceutical practices in contemporary China.

Chinese pharmaceutical Revolution; Pharmaceutical Crisis; Scientization of Chinese drugs

Understanding One Thousand Golden Drugs: Transformation of Pharmaceutical Practice from Pre-modern to Contemporary China

Sean Hsiang-lin Lei, Academia Sinica TAIWAN

What can we learn from a drug? Today we are surrounded by copious pharmaceutical products with alluring promises, yet it remains a challenge for biomedical researchers to develop efficacious drugs that can specifically target disease while minimizing side effects. The symposium explores this topic by examining how historical knowledge of drugs, mediated by epistemological and technological innovation, transformed biomedical research and pharmaceutical practice in modern and postcolonial China.

China, India, and Hong Kong Technology/Biotechnology Material Practice and Epistemology

Transforming Poisons: Techniques of Drug Processing in Pre-modern China

Yan Liu, University at Buffalo

Traditional Chinese pharmacy contained a large number of toxic substances that aimed to combat sickness. For instance, aconite, a highly toxic herb, was one of the most frequently prescribed medicines in pre-modern China. Other prominent examples included arsenic, mercury, and snake venom. How could poison become medicine? This paper intends to address this question from a technological perspective. It explores the rich repertoire of techniques devised to transform toxins into powerful medicines. Focusing on an influential pharmaceutical text *Leigong paozhi lun* (Treatise on Roasting Drugs from the Lord of Thunder) that has a fifth-century core, the paper investigates the sophisticated techniques of heating, soaking, cutting, among others, which restrain the toxicity of a drug but still preserve its therapeutic efficacy. In the end, the paper argues that drugs in traditional China were not fixed entities with stable effects; they were highly malleable substances based on the way they were prepared. By highlighting this crucial aspect of drug materiality, the paper seeks to demonstrate the centrality of drug processing in Chinese pharmacy, which sheds light on the pharmaceutical practice today.

Poison; Medicine; Drug Processing; Materiality; China

020. The Science and Civilization in Korea Project: Issues and Opportunities in Writing East Asian History of Science from a Different Point of View

Women and the Construction of Science and Technology: The Case of Pre-modern Korea

Kim, Young-hee, KAIST (Korea Advanced Institute of Science and Technology)

This presentation deals with the construction of science and technology in terms of gender. The word “construction” has a double meaning. On the one hand, it refers to the dominant modern perceptual and institutional construction of Science and Technology, with its implications in terms of gender, race, and modernity. On the other hand, it refers to the construction of science and technology through the daily practices of non-professional people, especially women, in pre-modern Korea. This presentation argues that the former leads to blindness in the latter, and that seeing/recovering women’s everyday work as scientific and technological practices demands and is demanded by a theoretical reconceptualization of science and technology.

gender; modernity; Eurocentrism; science; technology

The Compressed Development of Science and Technology under Authoritarian Regimes in South Korea

Manyong Moon, Chonbuk National University

The purpose of this paper lies in examining the process of the “compressed growth” of S&T in South Korea during the 1960s-1970s, decades that are commonly dubbed the “Park Chung-hee era” (1961-1979). I will seek to determine the ways in which the compressed growth of S&T in South Korea was accomplished and the kind of relationship with the authoritarian political system in which such a

process developed. By mainly examining the relationship between the South Korean government and scientists & engineers during the 1960s-1970s, I will endeavor to demonstrate that the “government-led growth” of S&T in the country was not simply the result of the establishment and implementation of a top-down policy, well organized under a homogeneous and unified system. Interaction between the government, scientists and engineers, and the surrounding cooperative international environment and cooperation were also important factors.

compressed development; Park Chung-hee; authoritarian regimes; government-led growth

Applying the Methodology and Practice of Microhistory: the Diary of a Confucian Doctor, Yi Mun-gon (1495-1567)

Shin, Dongwon, Department of Science Studies, Chonbuk National University

Since microhistory’s approach to the past is based on an understanding of and a sympathy for the concrete details of human lives, its area of interests overlaps with the history of medicine and medical humanities, which examine illness and health. If we put a specific region and society in a specific period under a microscope and increase the magnifying power, we can understand the numerous network connections among the body, illness management, and medicine and how multilayered were the knowledge and power applied to them. And this approach of using microhistory to illuminate medical history can be more effective than any other historical approach. This article focuses on Yi Mun-geon’s extensive volumes of Mukchaeilgi 默齋日記 (Mukchae’s diary) in approaching medical history from the perspective of microhistory.

history of medicine in Korea. macrohistory. Confucian doctor

Offspring of Abstemious Literati, with Cell Phones: Modern Technology and Transformation of Everyday Life in South Korea

Tae-Ho Kim, Chonbuk National University

This paper traces the introduction of modern household and consumer technology and the changes they have brought to the everyday life of ordinary people in South Korea. In premodern Korean society, the influence of Neo-Confucian ethics led to praise for an abstemious life. However, after the end of the nineteenth century, Koreans encountered and enthusiastically adopted a remarkably wide range of modern gadgets, to the extent that currently South Korea boasts one of the most ‘technology-savvy’ populations in the world, a fact often illustrated by the high penetration rate of mobile phones and high-speed internet service. The new mode of everyday material life has also been co-constructed with a new intellectual and sociopolitical culture, as well as a new way of economic life. By focusing on materiality in everyday life, this paper aims to illuminate what technology has meant to modern Koreans, and how its meaning and relevance has changed over time.

everyday life; material culture; technology; modern Korea

021. Early Modern Cartography and the Manchu State (17th-18th C)

The Yongzheng Atlas and the Space of the Russian Empire

Gregory Afinogenov, Georgetown University

The 1727 Yongzheng Atlas is one of the most celebrated monuments of the Qing-Jesuit mapping enterprise. Few realize that at the time of its publication it was almost certainly the physically largest and highest-resolution map of Russia available anywhere in the world. The paper investigates how the atlas functions as a representation of Russian territory, highlighting ways in which the relative flatness of its depiction conceals meaningful choices and exclusions drawn in part from the sources that composed it. It compares the atlas to other eighteenth-century portrayals and evaluates how it may have hindered Russo-Qing diplomacy in the eighteenth century with its misleading depiction of crucial disputed border regions. The ultimate goal of the paper is to understand cartography as a phenomenon embedded in a much thicker account of Russo-Qing interactions, both the product of a global republic of letters and a local practice of Inner Asian geography and intelligence-gathering.

Russian Empire; Qing; Yongzheng Atlas; Inner Asia; Siberia

18th Century Atlas Production at the Qing Court and Its European Connections

Mario Cams, University of Macau

In 1719, a group of Qing officials and European missionaries presented an atlas to the Kangxi emperor (r. 1661–1722) at the imperial palace in Beijing. It covered not only the 15 Chinese provinces, but also today's Northeast China, Mongolia, Korea, and parts of Siberia, Xinjiang, and Tibet. This atlas, known in Chinese as Huangyu quanlan tu 皇輿全覽圖 or 'Overview maps of the imperial territories', can be considered a milestone in the history of cartography because it was the result of the largest mapping project based on exact measurements that the world had ever seen. Yet, little is known about how the many different versions and editions of the atlas, produced throughout the 18th century during the Kangxi, Yongzheng and Qianlong reigns, relate to each other. As a result, key questions regarding the production of cartographic material at the Qing court in the course of the 18th century and incited by the Kangxi-era mapping of Qing territories (1708-1717) remain unanswered. This presentation explores the different versions and editions of the resulting atlases, all of which were produced at the Qing court. It will also explore the European connection, as 18th century Qing cartographic practice involved the active support of several European missionaries.

cartography, qing china, jesuit missions, global history

022. Intellectual Geographies of Chinese Medicine

The bringing of a Buddhist sculpture to life by putting the five organs inside it:
A missing link between medical illustrations and Buddhist art in 7th -11th
century Japan and China

Chen Hao, Renmin University of China

This article examines a statue of Śākyamuni that was brought back from Taizhou, China by the Buddhist monk Chōnen to Seiryō Temple in Kyoto, Japan. Chōnen noted that, on the statue were the names of the sculptor and his patrons. The patrons, all of whom were female, also donated artificial organs made of silk, Sarira (Buddhist relics), jade and sandalwood. These artificial organs gave the statue a miraculous appearance, for example, one day, it was perceived to have a bleeding spot on its back as though it was alive.

How could five artificial organs (wuzang) give the appearance of life to a sculpture? This article tries to frame the intellectual background to this question by referring to the emergence of a new form of medical illustration showing the meridian lines and the five organs in the same picture. Many viewers, who were not medical experts, could easily overrate the importance of the five organs for they took a disproportionately large part of the whole picture.

This article will provide textual and visual evidence that this misrepresentation was widely accepted in the Buddhist community. Artisans and their patrons embraced this idea by donating artificial organs and putting them inside Buddhist sculptures. My goal is to find the missing link between the mistaken concept and actuality and the process whereby the relationship between human organs and the whole body was misrepresented. I also wish to explore the long lasting nature of this misconception which survived in visual representation across centuries and cultures, helping to perpetuate its own understanding of the body and human life to countless viewers.

medical illustrations; Buddhist art; 7th -11th century; Japan; China

Knowledge of bodily practice: The therapeutic exercises in Zhubing yuanhou lun (Treatise on the Origins and Symptoms of all Diseases), a seventh century Chinese medical text

Dolly Yang, University College London

This paper focuses on the transmission of knowledge about bodily practice, in particular, about the therapeutic exercises in Zhubing yuanhou lun 諸病源候論 (Treatise on the Origins and Systems of all Diseases), compiled at the decree of the Emperor Yang of the Sui dynasty (581-618 C.E.). The therapeutic exercises known as daoyin 導引 are physical exercises which incorporate breathing, self-massage, visualization and other techniques.

Many exercises in Zhubing yuanhou lun can be traced back to the practice of the masters of formulas (fangshi 方士) during the Han and the Three Kingdoms (206 B.C.E. – 280 C.E.). They were subsequently taken up by various Daoist sects as part of their self-cultivation regimes. By the Sui period, daoyin exercises were widely practised by all kinds of people, not just the Daoists, for their health benefits. A new way of incorporating and organising daoyin exercises into an authoritative medical text suggests not only that, at an official level, daoyin was accredited as an important part of medical care, but also that there was an intention by the Sui government to standardise and formalise this kind of bodily practice. Daoyin exercises were central to the teaching practice of the Imperial Medical Academy (Taiyishu 太醫署), a state-sponsored medical institution established by the Sui government to provide a new and more formal avenue for the transmission of medical knowledge. Teaching staff specialising in daoyin exercises formed by far the largest group in the Imperial Medical Academy.

As well as highlighting the elevated status of these exercises in medical education and practice during the Sui period, this paper draws attention to rich source materials fortuitously preserved in the received literature for 1400 years. The reconfiguration of this medical knowledge gives us an important insight into the kind of diseases considered suitable for treatment with daoyin exercises which may have relevance for medical practice today.

China; state; medical knowledge; transmission; bodily practice

“Circulation of Chinese Bodily Arts of Memory and Prognostication in Seventeenth-century East Asia”

Marta E. Hanson, Johns Hopkins University

The history of medicine has great potential to be one of the most productive entries into the global history of the early modern world. Medical products and doctrines, tools and practices, physicians and texts have traveled throughout the world on the wings of commerce, in the hulls of ships, and through the entourage of diplomatic and religious missions. Following the movement of medical concepts, technologies, texts, and even peoples across linguistic, social, and geographic boundaries, reveals processes of translation, assimilation, and transformation. In this paper, I examine the transmission of bodily practices called “hand mnemonics” (zhangjue 掌訣) related to “dactylomancy” or “finger divination” (qiazhi suanfa 掐指算法) and prognostication techniques based on “chronomancy” for predicting epidemics and reading pulses. These “bodily arts of memory and prognostication” first appeared in printed Chinese texts in the 1330s and were transmitted first to Korea in the early 17th-century Treasured Mirror of Eastern Medicine (Dongui bogam 東醫寶鑑, 1613) and then in Japan in the Correct Meaning of Medical Teachings (Ikosei 医教正意, 1679). I argue that these hand mnemonics not only illustrate physicians’ use of their hands as an early modern medical technology for memorizing, calculating, and prognosticating but also how the practices associated with them were received, translated, and changed depending on different institutional, social, and cultural milieus. The Korean court physician Heo Jun placed them within a new geographical frame on “Eastern Medicine” that was resonate in early seventeenth-century Korea and Japanese physician-astrologer Kusakari Sanetsu placed them within a unique Japanese astrological culture that flourished in late seventeenth-century Japan.

East Asian medical history; bodily arts of memory; medical prognostication

023. Society and Science in Late Imperial China

Should they believe in numbers? Or how to make numerology scientific

Bréard, Andrea, Universität Heidelberg

Abstract science and rational belief in the objectivity of mathematics as well as political efforts had gradually brought into question the whole future of Chinese cosmological and divinatory traditions in the late imperial era. This paper describes attempts to prove their rational foundations and the kinds of arguments brought forward to “prove” the scientific character of numerological systems.

Numerology; mathematics; China

The Reception of Tychonic Astronomy in the Late Ming and Early Qing China

Chu Longfei, Dept. of the History of Science and Scientific Archaeology, University of Science and Technology of China

The reception of Tychonic astronomy in the late Ming and early Qing China was an important issue in both history of Chinese astronomy and of scientific exchanges between East and West. Actually, this historical process was much more complicated than the current image presented by previous studies. As I found out, the Chongzhen lishu was revised more than once during the astronomical reform of the late Ming dynasty, which was launched by Xu Guangqi. Probably because of the continuous revisions, different kinds of errors and inconsistencies can be confirmed in the treatise, such as the severe inconsistencies between the texts, figures and tables in the solar and lunar parts. In the early Qing period, many Chinese scholars paid close attention to the Chongzhen lishu. Some of them tried hard to solve these problems and improve the Tychonic theory, and several eminent ones even succeeded, especially Wang Xichan, Mei Wending, Yang Zuomei, etc. Later in order to end the dependence on the Jesuits in scientific matters, Kangxi Emperor decided to compile a new astronomical treatise. Finally, many astronomical works of Chinese scholars were adopted into the Yuzhi lixiang kaocheng.

Tychonic astronomy; Chongzhen lishu; Yuzhi lixiang kaocheng; Late Ming and Early Qing; Jesuit science

Hygiene Propaganda to Women in Late Qing: Some Female Magazines as the Center

Fu Banghong, University of Science and Technology of China

Take some magazines like Female Students 女学生, Female Students Magazine 女学生杂志, Women's Time 妇女时报, Women 女报, Women's World 妇女世界 as the objects, this article looked into the propaganda to women concerned hygiene in late Qing. At the time, hygiene was a very broad concept that was relegated to the protection of life, including everything concerned to the body and mind. In addition to the translation of the knowledge of physical health, such as the structure and function of brain, heart, mouth, nose, ears and other human organs, and the correction of the original understanding by analyzing the cause of the diseases. Hygiene knowledge introduced in these magazines also appeared some salient features. One is to emphasize the idea of breaking the superstition of ghosts and gods, giving up worshipping Buddha and begging ghosts, for it can do nothing for man's health, and is just a fool of health 卫生愚民. Another is to emphasizing the popularization of health knowledge, the importance of the countrymen's health for the country. And last, about the discussion of women's health, it is fragmented. Besides the knowledge to do a good job of home economics, there were also no lack of women's beauty, menstrual care and other specialized knowledge concerned women themselves, and even suggestions on women's career expansion. In general, propaganda of hygiene to women at this period showed a tendency of caring for women and discussing women's role from a social point of view. But just from the popularization of women's health knowledge, no significant feminist movement tendency can be seen.

Hygiene Propaganda, Women, Female Magazine, Late Qing

The Historical Significance of An Qingqiao's Temperament Theory

Hu, Huakai, Dept. of History of Science, University of Science and Technology of China

An Qingqiao(1759-1830) was born in Yuanqu, Shanxi province. He became a Jinshi(a successful candidate in the highest imperial examinations) in the fifteenth year of Qianlong Dynasty and also served successively as a magistrate of Sanshui County in Shanxi province. He was an officer free from corruption. During spare time, he immersed himself in Chinese traditional academy and he did well in mathematics, astronomy and temperament. As an accomplished scientist, he had numerous masterpieces and held that "Confucians' study must focus on investigate things to extend knowledge. However, they must discuss principles with Shu(number). Without principles, the Shu was similar to skills. Without Shu, principles amounts to void " while the Neo-Confucianism emphasized on investigation of things and the extension of knowledge. In his mind, to recognize the truth of things, we must recognize that things have the attribute of Shu in that Shu is the reflection of principles, it reflects the truth of things. Therefore, in his work of mathematics, astronomy and temperament, he tried to reveal the nature of mathematics from the relevant content and summarized the rules it follows. Previously, in the field of the science of history, few people paid attention to An Qingqiao's work. In recent years, some scholars had a discussion on his scientific work, but it's not enough yet. In order to make an objective evaluation about the historical significance, based on the existing research, this paper had a systematic analysis and summarization on his temperament theory, which includes six points raised by An Qingqiao:

(1) The main point of temperament is the proportions of mathematics. Once it out of proportion, the sound and tone will not be harmonic; (2) His method of continued proportion to calculate temperament was an improvement on computing method of Zhu Zaiyu's twelve-tone equal temperament; (3) The twelve-tone temperament is a virtual rate, it only reflects the proportional relation of every temperament and it cannot represent the real length; (4) The argument on the length of Huangzhong pipe is meaningless, because the length is out of unconditional; (5) Whether pipes pronounce voice or not, it all determined by the lumen size, if lumen size of pipes meets proportions, the pronunciation is harmonious; (6) The temperament has nothing to do with the degree, quantity, value and using Huangzhong to determine the units of measurement is not necessary.

Historical Significance; An Qingqiao; Temperament Theory

The role of alchemy in constructing the Chinese scientific tradition

Iwo Amelung, Goethe-University, Frankfurt am Main

Chemistry has become one of the most important fields of Chinese history of science. As other disciplines it is discussed in numerous articles and monographs with titles such as History of Chinese chemistry (Zhongguo huaxue shi) etc. While our understanding of the Chinese alchemical tradition has greatly increased in recent times, the question how the history of Chinese chemistry, which of course was closely related to the discourse on Chinese alchemy, remains still quite obscure.

In this paper I will attempt to provide a first look on the early stages of the historiography of Chinese chemistry and alchemy. I especially will focus on the following problems:

1. How was the Chinese alchemical tradition integrated into an universal history of chemistry?
2. To what extent was this shift related to the reception of Western concepts of chemistry since the end of the 19th century?
3. How can the interaction between Western and Chinese attempts to understand the history of Chinese alchemy be characterized?
4. Who were the scholars and scientists looking into the history of Chinese alchemy?

My analysis will be based on a wide range of sources, including material written within the framework of the so-called „Chinese origins of Western knowledge“ discourse (Xixue zhongyuan),

ICHST
2017

early efforts of the popularization of science as well as academic articles and monographs written during the 20s and the 30s of the 20th century.

China; historiography of science; alchemy; Western knowledge

Chinese Observations of Western Observatories in the 19th Century

Lyu, Lingfeng, Dept. of History of Science, University of Science and Technology of China

Out of their curiosity and desire for western science, some intellectuals of the late Qing Dynasty visited several prestigious astronomical observatories in Europe and the US, such as Harvard College Observatory, Paris Observatory, Greenwich Observatory and Oxford Observatory, when they had a journey or dealt with diplomatic affairs in those regions. Their observation and view of the western observatories were recorded in detail in their travelogues or journals, which included some introduction of western astronomical observation knowledge and instruments, and some of their thinking on western cosmology. With full analysis of this kind of information, this paper will discuss that these intellectuals' views of the world and the heaven based on traditional Chinese astronomy were challenged on the site of western knowledge, which also influenced their attitude towards western learning.

Western Observatory; Chinese intellectuals; Late Qing China

The source, influence and evolution of the misunderstanding on the epoch in Huihui Lifa

Pan Yue, School of History and Culture of Science, Shanghai Jiao Tong University

The Chinese-Islamic calendar, namely Huihui lifa, had made a misunderstanding on the Islamic epoch. Instead of the correct epoch A.D.622, it took A.D.599 as its epoch. This misunderstanding was caused by the confusion on the lunar and solar calendar. Newly found materials prove that this misunderstanding occurred not long after the translation of Huihui lifa at the early period of Ming Dynasty. The calendar Weidu Taiyang Tongjing, which was compiled by Yuan Tong, shows the influence of the misunderstanding on the calculation of Chinese astronomers. During the late period of Ming Dynasty, Chinese scholars had also been aware of the problem on the epoch, and they used an algorithm called jiaci fa to make some kind of correction. In Qing Dynasty, another misunderstanding, which said there were two different epochs for Islamic calendar, was propounded by Chinese scholars including Mei Wending and Li Rui. This study shows that the Islamic calendar had failed to be accepted or understood by the system of Chinese astronomy.

Huihui Lifa; Yuan Tong; Mei Wending; Li Rui; cultural exchange

Dragons without their King: The Changing Dynamic of Science and Popular Religion in Seventeenth-Century China

Qiong Zhang, Wake Forest University

One category of natural spirits in Chinese popular religion had an especially robust staying power. For millennia, dragon kings, thunder gods and the like had been invoked to account for various atmospheric phenomena and were supplicated to in times of drought and other inclement weather conditions. The tenacity of these beliefs and practices in part stemmed from their symbiotic relationship with the notion that some of the living creatures among the realm of *wu* (things) such as the dragons had an extraordinary role to play in the making of weather. However, that symbiosis was to suffer the first significant setback during the late Ming and early Qing as a result of several concurrent local and global developments. In this paper, I will explore how the interplay of two such developments – the turn to empirical observation and ethnographic reporting as new modes of natural inquiry and the circulation of a “Jesuit brand” of Aristotelian natural philosophy and other fields of Renaissance European learning among Chinese intellectuals – threatened to *conceptually* liquidate the dragon kings and their spiritual cohorts. Focusing on a circle of scholars formed around Fang Yizhi and included such prominent members as Jie Xuan and You Yi, I will closely examine their writings on topics that intersected with Aristotelian meteorology and Renaissance natural history. My research indicates that in their creative adaptation of Aristotelian meteorological principles, these scholars counted out such aquatic animals as lizards and giant clams from their meteorological system. They also came close to concluding that the basic cast of blue, red, white, and black dragons that had been a perennial fixture in Chinese meteorological records were simply metaphorical, dragon image-based typologies of cloud formations. Ironically, they stopped short of pursuing that conclusion to the tilt, because the marvelous tales told by the Jesuits about the exotic creatures of a whole new world expanded the realm of possibility for these Chinese scholars, making the rain-making dragons and thunder-generating birds depicted in Chinese sources more credible. Nonetheless, these scholars were on the way of developing a new scientific culture centered around the investigation of materiality and mechanisms that ultimately rendered them skeptical of the spiritual counterparts of what remained of the mighty “weather animals.”

early modern meteorology; weather animals; dragons; natural history; Jie Xuan

Communicating European Astronomy to Chinese Readers in the 17th Century: Knowledge Strategy in the Chongzhen Reign Treatises On Calendrical Astronomy

Yunli Shi, University of Science and Technology of China

When the Jesuit astronomers, including Johann Schreck (1576-1630), (Johann Adam Schall von Bell, 1591-1666) and Giacomo Rho (1593-1638), were invited to the Bureau of Calendar set up by the Ming Dynasty for the reform of its long outdated system of calendrical astronomy, they had to deal with one important issue, i.e. how to communicate European astronomy to the Chinese readers who were accustomed to a totally different tradition in astronomy which had been lasted for more than a thousand years in this country, a tradition that did not based their description, analysis and computation of the celestial motions on strict geometric models. Not only did they have to make their introduction understandable, but they also had to make it convincing to Chinese readers. Through a detailed analysis of the knowledge structure and wording style of the work, these paper tries to reconstruct the strategies that they used to address this issue.

Knowledge Communicating; European Astronomy; Chinese Readers; The 17th Century

024. Studies in the History of Metrology in the Cross-cultural View

The original concept of angle and its application in Kao Gong Ji

Guan Zeng-Jian, School of history and culture of science, Shanghai Jiao Tong University

Abstract : central°Since there was no 360 angle system in ancient China, how did the ancient people deal with the problem of angle when coming to them? The answer could be found in the ancient book Kao Gong Ji. Kao Gong Ji is the oldest known book on technologies in China. It is also a part of an important classical work of Confucianism. Because this book for its greatest part probably originated on the border between the Chunqiu (770 — 476 B.C.) and the Zhanguo period (475 — 221 B.C.), that is about 2500 years ago, Kao Gong Ji at the same time counts to the oldest technological works worldwide. Through detailed studies we find there were already some proper nouns stood for abstract concept of angles and some specific angles used as technical standards in Kao Gong Ji. These angles were constructed by performing geometric operations on the basic angle Gui or Ju. What the so called the contradiction of Jugou Qingzhe does not exist.

history of metrology; angle concept; ancient scientific classics

Study on the Transmission of Traditional Chinese Metrological Knowledge to Japan

Rina Sa, Shanghai Jiao Tong University

Abstract: Chinese traditional metrology imposed a far-reaching influence to its neighboring countries during its own development. The development of metrology in Japan, one of the country in the Chinese-character circle, has been affected by Chinese traditions since ancient times. The paper, by consulting huge amount of relevant Japanese and Chinese primary and secondary sources, summarizes the influence of Chinese metrology in various stages on its Japanese counterpart in terms of traditional science and technology exchanges. Taihōrituryō, charted in 701 A.D, is the first basic code in ancient Japan, which is a compilation of such ancient regulations and laws in Japan since 7th century as Ōmiryō, Tenmuryō with certain amendments, supplementary and revisions. The paper analyses the connections between two different metrological systems in Japan and China through a comprehensive comparison between Taihōrituryō and The Tang Dynasty law system. Moreover, Japanese metrological system boasts its own features as well as corresponding Chinese characteristics. Shakkan-hō can be considered as a typical example, a system embedded with remarkable Japanese features. In this system, Shaku is regarded as length unit while Kan is an original mass unit in Japan which equals to “Jin” in Chinese units system. The traditional industry in Japan, according to Ei Rokusuke, a Japanese scholar, will not be well-developed without employing Shakkan-hō. Therefore, the paper examines the differences and similarities between Chinese and Japanese traditional metrology with a case study of Shakkan-hō, and carries out a comprehensive analysis of the changes in metrology in Edo period. Plus, the paper conducts an overview of the systemization and development of Japanese traditional metrology under the influence of its Chinese counterpart in terms of social construction, ideology and culture.

China; Traditional metrology; Japan

Simulating Clepsydra: Two Methods of Time Measurement for Military in Ancient China

Wang Xiaohu, South China Normal University

Clepsydra was the most important time measurement device in ancient China. While clepsydra measuring time, it required two basic components: Pots and Scale-rulers. The Pots included Water-dropping Pot and Water-receiving Pot, which could the water be flowing continuously just as the elapsing of the time. The Scale-rulers were made of wood or bamboo, floating on the water in the Water-receiving Pot. When the clepsydra was working, people could read the rising of the water level through the graduation on the Scale-ruler, thus the elapsed time could be quantified. When ancient Chinese made use of clepsydra to measure time, a whole day was often divided into two parts: day time and night time. Therefore there were two starting points for time measurement: sunrise and sunset. This operation was quite different from clock and watch we are using nowadays. Since the cycles of sunrise and sunset - the time starting points, changed annually, ancient Chinese had to change different Scale-rulers to adapt it. Chinese official calendrical system was a special astronomical knowledge system that included series of data about different Length of Day & Night or different Time of Sunrise and Sunset. This is the reason how the ancient Chinese changed Scale-rulers of clepsydra.

Besides clepsydra, ancient Chinese also developed many methods for time measurement. In this paper, two cases in military documents are introduced : Pace-counting and Bead-counting. While the former research thought these methods were other different 'instruments of measuring time' for military in ancient China, this paper aims at proving that they were the simulations of the clepsydra. And according to the data in the original texts, the two methods must be operated with the length of Day & Night provided by the official calendrical systems.

With the idea of simulating clepsydra, ancient Chinese tried to walk and shift beads at uniform speed. In fact, people counting the paces and the beads were just like the quantifying of continuous water flow between the Water-dropping Pot and Water-receiving Pot. While measuring time, they must consult the day & night time in the official calendrical systems. The principle behind this behavior, was the same as the changing Scale- rulers of clepsydra. By these cases, we could have a new perspective on the understanding of ancient Chinese about time measurement.

Time measurement; Clepsydra; Calendar; Pace-counting ;Bead-counting

The Background and the Cause of the Practice Unifying Weights and Measures in the Late Qing Dynasty

Yang Zesong, Shanghai Jiao Tong University

This thesis is focused on the the background and the cause of the metrological reform in the late Qing dynasty. After the 1900 incident, China had been a semicolonial society. The management of traditional Chinese standard of weights and measures was out of order. In order to reinforce dominance and meet the requirements of the strong countries, the Qing government began to unify weights and measures. There were some kinds of solutions for choice, included English model, French model, Japanese model, traditional Chinese model and the other model based on modern metrological. During this period, the controversy and conflicts had always been existed, which reflected the complexes and hardship of the China's modernization in that time.

"management of weights and measures"; "history of metrology"; "late Qing Dynasty"

Unitized Time: A Study on the Relations between the Time of Solar Terms Noted in Calendar and the Course of Unitary Multi-Ethnic State Emerged in Qing Dynasty

Yuyu Dong, Shanghai Jiao Tong University

From the era of Emperor Kangxi, the Qing Government carried out a series of scientific activities such as geodesic survey, mathematics and astronomical education, compiling the mathematics and astronomical books and so on. The results of these activities embodied not only in national map publishing, is also reflected in the almanac in Qing Dynasty. Calendar played a special part in the society of ancient China. One hand, it had scientific functions related to metrology of time, which served as astronomical observing, time keeping and so on. On the other hand, it had social functions, served as astrology, date selecting and so on. As a symbol of unitized time, Calendar played a special part in the course of unitary multi-ethnic state emerged in Qing Dynasty. The paper studies the time of solar terms noted in calendar how to spread from Northeast, Mongolia, Xinjiang, Tibet and so on, the time of solar terms noted in calendar how to spread from Korea, Annan, Liuqiu as vassal state and so on. The paper draws conclusion: The accurate time identified of solar terms noted in calendar was the result that western learning spreads to the East caused the innovation of Chinese traditional knowledge. Especially, geodesic survey not only was important to made map, but also brought out impact on calendar. The proceeding about the time of solar terms noted in calendar was related to politic and military affairs in Qing Dynasty. The proceeding about the time of solar terms noted in calendar was also a symbol of reconciling the Man Han Mongolia Hui and Zang nationality

Unitized Time;Calendar;Qing Dynasty

Du and UŠ: Units of Measurement in Celestial Observations in China and Mesopotamia

Yuzhen Guan, University of Science and Technology of China

In China, a $365 \frac{1}{4}$ du equatorial system is widely used in celestial observations. Du literally means degree as used for angle measurement, however, research has shown that in celestial observations it is used as a unit of length rather than angle. In Mesopotamia, UŠ represents even more meanings than the Chinese du. It is a basic terminology in both length and time measurement in celestial observations. Based on discussions of the context and ways to use du and UŠ, this research aim to explore the similarities between the Chinese and the Mesopotamian celestial measurement systems. It will compare the ways of using length terminologies in both cultures, such as the 'Normal Star System' in Mesopotamian astronomy and the reference stars in Chinese astronomy. For example, in Mesopotamia, there are records that the positions of the celestial bodies are related to the Normal Stars not by coordinates counted in degrees but in distance terminologies, such as 'cubits' and 'fingers'. This research will further present a similar way of distance terminologies in celestial measurement in Chinese astronomy. The aim of this paper is to explore Chinese and Mesopotamian conceptions of units of measurement. A selection of sources is explored to reveal the notions in celestial observations. It is hoped that this will result in a better understanding of the diverse roles of terminologies in the development of Chinese and Mesopotamian astral sciences.

Du; UŠ; Celestial Measurement

On the Enlightenment and the Formation of China's Traditional System of Weights & Measures

Zhao, Xiaojun, Luoyang Municipal Institute of Cultral Relics and Archaeology

Weights & measures are the objects used for weighing and measuring and they are an important aspect of measurement. It took a long period for the traditional Chinese measurement system to form.

The crude system of weights & measures first appeared in late Neolithic times. It was the result of the development of mathematical concepts, the change of social structure, the accumulation of wealth, the social stratification, the emergence of private ownership, as well as the complication of the social division of labor. By late Neolithic times, the social structure changed apparently and the Chinese entered the stage of patriarchal society with the emergence of private ownership and social stratification. To meet the needs of wealth allocation, building cities, making fine goods, etc., some objects with definitive measurements were used for weighing and measuring and the crude system of weights and measurements appeared as the result of a long period of accumulation of mathematical knowledge and the change of social structure.

The mature system of weights & measures were created in the Xia dynasty with the intensification of social production, the appearance of the state and state apparatus. With the development of social institutions and the increasing of large scale agricultural and manufacturing activities, people had to work together to accomplish their goals, such as building a city, a palace or something like the "Yu the Great Taming the Floods," which generated the need for standard weights & measures. In the meantime, with the appearance of the state apparatus, the national taxing, the payment of salary and the standardization of war production also needed standard weights & measures.

It can be seen from this that the traditional Chinese system of weights & measures began taking shape in late Neolithic times after million years of accumulation of mathematical knowledge and the changing of social structure. However, the system was not sohiscated untill the Xia dynasty with the intensification of and the appearance of the state and state apparatus.

Enlightenment; Formation; China; Weights & Measures

025. The interface between the study of cultural diversity in science and decision-making in science policy

Regulating Toxicity: Negotiations around Safety and Risk

Annamaria Carusi, University of Sheffield

Toxicology is a research area that is closely aligned with policy and regulation, as it potentially has something to say about almost any substance that interacts with human and animal bodies and the environment. It is currently going through a profound shift, brought about by the combined and closely interconnected forces of technological, social and institutional change. Technologies that are playing their part in this shift range across computational, experimental and social media technologies, exemplifying the close inter-relationship between science and social interactions.

Communities that are engaged in the changing face of toxicology include environmental and other governmental agencies, industry, NGOs, academic institutions and others, representing a wide range of different cultures with respect to knowledge, purposes and values, all of which affect the distribution of risks and responsibilities, the use of human and non-human animals for safety testing, and the tensions between these. This paper discusses the relationship between science, policy and regulation against the background of these current shifts in toxicology.

Toxicology; Safety Testing; Distribution of Risk

How cross cultural epistemic injustice in the global health arena undermines public health care delivery in Africa

Helen Lauer, University of Dar es Salaam

Joan Shenton, Director of Meditel Productions

Assertions of scientific fact are a tightly supervised commodity when produced and promulgated by globally recognised specialists and the highest profile knowledge-generating agencies. But with increasing dependence upon protocols of recognition and deference to internationally legitimised expertise there emerges a prevailing climate of complicity in censorship. Increasingly, the discouragement of independence and diversity of perspectives and the consequent attrition of on-going evidence-based controversy has had severe repercussions on public welfare worldwide. Paradoxically, orchestrated suppression of critical exchange is affected by virtue of the very regulations and protocols designed to ensure that scientific productivity remains impartial, comprehensive, open to evidence-based criticism and subject to revision by means of the stringent rigours of conjecture and refutation among rival perspectives. The point of this analysis is to demystify and account for this paradox.

To ground the discussion in concrete terms, this analysis will be limited to the dynamics responsible for perpetuating falsehoods about the pathogeneses that proliferate in Africa, by systematically delegitimizing and disregarding local African scientists and medical experts.

Case examples are culled from observing the practices definitive of the international scientific network that dominated the direction and funding of AIDS research in 1991-1992 conducted in Kenya, Uganda, Tanzania, Cameroon and Cote d'Ivoire, in the global collaborative effort of governments, industry, and academia to control an AIDS pandemic. Further examples derive from 2014-2015 in Guinea, Liberia, and Sierra Leone, demonstrating epistemic and documental injustices in the statistical reportage, the diagnostics, and public health care practices which were supervised under the aegis of global scientific, military, and epidemiological expertise collaborating in the high profile West Africa Ebola Emergency Response.

These documented incidents from these periods of international collaboration and intervention on behalf African publics demonstrate how accredited global authorities systematically exclude those independent experts who happen to have the greatest pertinent opinions, background knowledge and direct access to crucial evidence, given their locations in the periphery of the cross cultural domain of scientific knowledge production, financial management and decision making.

Public Health; Africa; Cross Cultural Epistemic Injustice

How cross cultural epistemic injustice in the global health arena undermines public health care delivery in Africa

Joan Shenton, Meditel Productions

Helen Lauer, University of Dar es Salaam

Assertions of scientific fact are a tightly supervised commodity when produced and promulgated by globally recognised specialists and the highest profile knowledge-generating agencies. But with increasing dependence upon protocols of recognition and deference to internationally legitimised expertise there emerges a prevailing climate of complicity in censorship. Increasingly, the discouragement of independence and diversity of perspectives and the consequent attrition of on-going evidence-based controversy has had severe repercussions on public welfare worldwide. Paradoxically, orchestrated suppression of critical exchange is affected by virtue of the very

regulations and protocols designed to ensure that scientific productivity remains impartial, comprehensive, open to evidence-based criticism and subject to revision by means of the stringent rigours of conjecture and refutation among rival perspectives. The point of this analysis is to demystify and account for this paradox.

To ground the discussion in concrete terms, this analysis will be limited to the dynamics responsible for perpetuating falsehoods about the pathogeneses that proliferate in Africa, by systematically delegitimizing and disregarding local African scientists and medical experts.

Case examples are culled from observing the practices definitive of the international scientific network that dominated the direction and funding of AIDS research in 1991-1992 conducted in Kenya, Uganda, Tanzania, Cameroon and Cote d'Ivoire, in the global collaborative effort of governments, industry, and academia to control an AIDS pandemic. Further examples derive from 2014-2015 in Guinea, Liberia, and Sierra Leone, demonstrating epistemic and documental injustices in the statistical reportage, the diagnostics, and public health care practices which were supervised under the aegis of global scientific, military, and epidemiological expertise collaborating in the high profile West Africa Ebola Emergency Response.

These documented incidents from these periods of international collaboration and intervention on behalf African publics demonstrate how accredited global authorities systematically exclude those independent experts who happen to have the greatest pertinent opinions, background knowledge and direct access to crucial evidence, given their locations in the periphery of the cross cultural domain of scientific knowledge production, financial management and decision making.

Public Health; Africa; Cross Cultural Epistemic Injustice

Different disciplinary cultures of explanation in science

Matthew Inglis, Mathematics Education Centre at Loughborough University

Across the world there is an increasing requirement for scientists to demonstrate the value of their research. For instance, in the UK, university departments are assessed, in part, on the reach and significance of their "research impact". One of the mechanisms policymakers suggest that researchers can demonstrate impact is by communicating science to the public. This potentially covers a wide variety of activities, but a recent Royal Society survey (<http://bit.ly/1zyHIER>) found that scientists believe that explaining science to non-specialists is the primary goal of public engagement. But what does it mean to explain a scientific idea? And are there disciplinary differences in this respect? A particularly interesting case to investigate is mathematics, where the objects of study (if they exist) are not causally connected to each other or ourselves. Factors such as these have led some philosophers to deny that mathematical results can be explained at all, citing as evidence that few mathematicians explain their own work. For instance, Resnik & Kushner (1987) claimed that "mathematicians rarely describe themselves as explaining" (see also Zelcer, 2013). But this position was rejected by Hafner & Mancosu (2005) who asserted that "Contrary to what Resnik and Kushner claim, mathematicians often describe themselves and other mathematicians as explaining." Similarly, Weber & Frans (2016) suggested that, although Zelcer and Resnik & Kushner were correct to point to a lack of evidence regarding the frequency of mathematical explanations, this was merely because no one had attempted to collect such evidence.

Our goal here is to report such evidence. We investigated whether mathematicians do in fact often claim to explain, by comparing their explanatory behaviour with that of physicists. We did this by constructing and analysing a large corpus of mathematics and physics research texts.

We found that mathematicians appear not to frequently assert that they are explaining, and that the explanatory family of words is used considerably more frequently by physicists than mathematicians. We also found that physicists more often talk about "explaining why" than mathematicians, and that mathematicians are more likely to 'explain how' rather than 'explain why'. We discuss some possible

accounts for these differences, and speculate on what different disciplinary cultures imply for science-wide policy on issues such as public engagement.

Research Impact; UK; Science Communication

ADHD across Cultures and over Time

Nina Atanasova, The University of Toledo

Diagnosing and treatment of Attention Deficit Hyperactivity Disorder (ADHD) varies widely across countries around the world. Numerous studies have clearly shown a disproportionate prevalence of the diagnosis in the US in comparison with other countries. Some of the difference can be accounted for by the use of different diagnostic criteria. The Diagnostic and Statistical Manual of Mental Disorders (DSM), commonly used for diagnostic purposes of mental disorders in the US, recognizes lower thresholds of symptoms compared to the International Classification of Diseases (ICD) which recommends diagnosing of hyperkinetic disorder at thresholds corresponding only to severe cases of ADHD as categorized by the DSM. However, the evidence that the difference in diagnosing might be due to cultural idiosyncrasies in evaluating the symptoms and conceptualizing the disorder is abundant. In this paper, I analyze differences in conceptualizing ADHD, and mental illness more generally, across cultures and over time with the goal to articulate strategies for better theoretical and practical approaches to the study and treatment of the disorder to the extent to which it is an objective biopsychosocial phenomenon.

ADHD; Mental Illness; Diagnostics

Preserving Academic Traditions over Ages – the Case of Estonia

Peeter Mürsepp, Tallinn University of Technology

Estonia is a small country in Northern Europe that has experienced a variety of cultural influences. For seven hundred years, since early XIII to early XX century the country belonged to the German speaking cultural environment. At the same time, the rulers included the Danish, the Swedish and the Polish (in the southern part) kingdoms and the Russian Empire since 1710. However, even the latter preserved German as the official language on the Estonian territory. After a short period of independence, the country fell under the Soviet rule. Independence was restored in 1991. This kind of complicated historical past suggests that there must have been quite different cultural influences to play their role concerning the scientific scene as well. The country has taken something from all these different influences of course. Still, the backbone of the scientific activities and policies have remained the same by and large. For instance, University of Tartu that was founded by the Swedish King Gustavus II Adolphus in 1632 has remained an advanced center of research ever since with the exception of the XVIII century the most part of which it did not operate. The Swedish mathematician Sven Dimberg taught the method of Newton in Tartu in the year 1693 already. If there had been no David Gregory in Edinburgh, Dimberg would have been the very first to do so. This is a significant achievement for a then easternmost university in Europe. The University of Tartu was reopened in 1802 as the result of the activities of a polymath, Georges Frederic Parrot. Parrot, a Frenchman educated according to both the French and the German traditions, brought the ideas of the Enlightenment to the region. The University of Tartu became one of the leading universities in the whole world in the XIX century concerning several fields of research. The Soviet period of 50 years interrupted the connections of the university and whole country to the western academic world but

ICHST
2017

the interruption was brief enough and reconnection has been successful. Still, it is interesting to observe that Estonia remains between different academic cultures. Partly, the historical German-Russian tradition has been preserved. But the tendency to move towards the Scandinavian way of organizing research and the whole academic life is strengthening on the daily basis. One could claim that the language of instruction plays an important role here.

cultural influences; Northern Europe; research traditions

Cultural and Political Aspects of the First US-USSR High-Energy Physics Experiment at NAL

Vitaly Pronskikh, Fermi National Accelerator Laboratory

E-36, an experiment on small angle proton-proton scattering, began testing equipment in the National Accelerator Laboratory's newly achieved 100-GeV beam on February 12, 1972, marking the beginning of NAL's experimental program. This experiment, which drew collaborators from NAL, Joint Institute for Nuclear Research (JINR at Dubna, USSR), the University of Rochester (Rochester, New York) and Rockefeller University (New York City) was significant not only as a milestone in Fermilab's history but also as a model of cooperation between the East and West at a time when Cold War tensions still ran high. An examination of the origin, operation, and resolution of E-36 and the chain of experiments it spawned reveals the complex interplay of science and politics that drove these experiments as well as seeds of the megascience paradigm that has come to dominate high-energy physics research since the 1970s.

In this talk I will discuss cultural aspects of the US-USSR collaboration such as mixed language communication in the course of experimental preparations, learning of each other languages by the participants, assigning US companions to the Soviet physicists to create a friendly environment for the newcomers to help them better adjust to unfamiliar surroundings, social calendar and entertainment program as well as English language courses for the Soviet participants at NAL. I will also focus on political aspects of the collaboration, namely, the decision to host the Soviets as guests of NAL and to cover their housing expenses at times of their financial hardship, the roles of the scientists as informal ambassadors, and a number of political steps undertaken by the NAL Director R. Wilson to enable and facilitate the US-USSR collaboration. I will give examples how the E-36 collaboration at NAL helped create many enduring relationships between members of the US and Russian teams and contributed to rapprochement between otherwise hostile countries and relaxation of the Cold War tensions.

Cold War; USA; USSR

026. State of the art in the history of mathematics in Iberoamerica

**A new interpretation of the history of the foundations of mathematics.
Francisco Vera, a case study**

Alejandro Garcíadiego, Universidad Nacional Autónoma de México

Previously, a standard interpretation of the origins, development and consequences of the set theoretic paradoxes asserted that these arguments aroused, at the beginning of the XX century, as a consequence of the criticisms towards Cantor's works and, eventually, they also stimulated the development of controversies among the three main leaders of different schools of thought towards

the foundations of the discipline. For several decades, this interpretation, with small variants, seemed technically and chronologically coherent.

But, approximately thirty years ago, a new historical reconstruction emerged questioning the origins and role played by the set theoretic paradoxes at the turn of the XX century. This new reconstruction argues that it was Russell who, almost single handed, discovered these statements while writing a book on the principles of mathematics. On one hand, among many other issues, historians are still discussing how and when Cantor discovered his own argument of the largest of all cardinal numbers. On the other, scholars have also questioned some of the consequences of such new account. In particular, some argue that these schools of thought did not originate from the discovery of the paradoxes. On this occasion, we will discuss and analyze the work of Francisco Vera to see if it fits this new account.

mathematics; history; foundations; paradoxes; crisis

Overview of the History of Mathematics in Colombia

Clara Helena Sánchez B., Universidad Nacional de Colombia

Víctor S. Albis G., Universidad Nacional de Colombia

In 1973 Víctor Albis, supported by the Colombian National University and the Colombian Society of Mathematics, presented a project to COLCIENCIAS whose main purpose was to identify and recover the patrimonial wealth of Colombian mathematical production, since colonial times up to our days. Since then, due to the work of both authors and their students, a reconstruction of a significant part of Colombian mathematical history, have been achieved. This history begins with the chair of mathematics, in 1762, at the Colegio Mayor de Nuestra Señora del Rosario in Bogotá, held by the Spanish surgeon José Celestino Mutis. Broadly this history admits three well differentiated periods: from Mutis to the establishment of the Colegio Militar, in 1848; from the Colegio Militar up to 1951, when the first program on pure mathematics is started up in order to form professional mathematicians. In this paper we intend to give an overview of this history, emphasizing the most relevant points of change and the main protagonists in each period.

History of Mathematics; Colombia

The mathematics institutionalization process in Brazil: the role of Lélío Gama at the Federal District University

Fábio Ferreira de Araújo, Instituto Federal de Educação, Ciência e Tecnologia do Rio de Janeiro

This paper analyzes the changes in mathematics teaching in Brazil from the creation of the first licentiate degree courses in the 1930s. Unlike what occurred in the former year at São Paulo University, which strategy was hiring foreign teachers, the Federal District University gave priority to hiring mostly Brazilian intellectuals and professors of existing institutions. Since 1925, Lélío Gama (1892-1981) worked at the Polytechnic School of Rio de Janeiro as an assistant in Rational Mechanics. He was responsible for the Mathematics Department of the Federal District University School of Sciences, in charge of managing the graduation course and working as a professor in Analysis. Current historiography highlights him as one of the persons responsible for renewing the approach in mathematical concepts. This statement raises the following questions: how were these changes made? Were they imposed since this is a teacher training course? What teacher profile was this new institution intended to educate? Despite the apparent contribution to the mathematics institutionalization process in Brazil, Lélío Gama is rarely cited as a

researcher in mathematics by his successors, who prefer to emphasize his role as a consultant and manager in major scientific institutions in Rio de Janeiro: National Observatory, Brazilian Center for Physics Research, National Research Council and the National Pure and Applied Mathematics Institute. However, to what extent was his administrative career not related to his scientific work? Is there a way to dissociate them? This research will be conducted as from manuscripts obtained in his file, located in the Museum of Astronomy and Related Sciences, and articles published in the Brazilian Science Academy Historical Records, both produced concurrently with his activities at the university.

History of Science in Brazil; Mathematics institutionalization in Brazil; Lélío Gama

Francisco Jose Duarte y su cálculo de los decimales de π

Leo Corry, Tel Aviv University

Francisco Jose Duarte (1883-1972) fué un destacado matemático venezolano con un campo de intereses muy variados. En 1908 publicó un cálculo de los primeros 200 decimales en el desarrollo de π . En mi ponencia discutiré el contexto histórico de sus intereses y de esta publicación, basado en documentos inéditos. Usaré el caso de Duarte para discutir algunos puntos sobre la historiografía de las matemáticas en Latinoamérica.

Mathematics; Latin America; Venezuela; Duarte

Perspectives on the research on History of Mathematics in Portugal

Luis Manuel Ribeiro Saraiva, CIUHCT/D. Mat. Faculdade de Ciências de Lisboa

In the first part of our talk we will give a perspective of the history of the research on history of mathematics in Portugal, since its beginnings, with the pioneering works of António Ribeiro dos Santos (1745-1818) and Francisco de Borja Garção Stockler (1759-1829). We will outline its developments until the 1980s, in special emphasizing what is called the “golden age” of Portuguese historiography in this area, the period 1900-1940, in part motivated by the presence of Portugal in several international prestige events where the participating countries expounded the development of its research in various artistic and scientific areas. In particular we will summarize the contributions of Rodolfo Ferreira Dias Guimarães (1866-1918), Pedro José da Cunha (1867-1945) and Francisco Gomes Teixeira (1851-1933). The later was the most important Portuguese mathematician of the late 19th century and early 20th century, the founder of the first Portuguese international journal of mathematics, the “Jornal de Sciencias Mathematicas e Astronomicas” (founded in 1877). He was one of the main Portuguese mathematicians who created, together with Spanish mathematicians, the joint Iberian meetings of the Portuguese and Spanish Associations for the Progress of Science. In the second part of our talk we will give an outline of the most important developments in history of Mathematics in Portugal in the last 30 years. We will speak about the research centred in the various institutions created in Portugal in this period, including the military centres, namely in the Navy School (Escola Naval). But we will center our talk on what has been the congregating centre of the organization of meetings in Portugal connected to research on History of Mathematics, which has been the National Seminar for the History of Mathematics (SNHM), founded in 1988. We will give an overview of all its activities, including (since 1993) the regular international meetings with the Brazilian researchers, and, from 2013, the Iberian Meetings on History of Mathematics. In our talk we will also speak of the important series of meetings “History of Mathematical Sciences: Portugal and East Asia” which started regularly to be organized since 1995.

From Guanajuato to Stockholm. A letter from Vicente Fernandez to Mittag-Leffler

María Anaid Linares Aviña, UNAM

In the fall of 1885, Mittag-Leffler received a letter from Vicente Fernandez, director of the meteorological observatory of the state school of Guanajuato, Mexico, in which he made known the reception of the call for the prize dedicated to King Oscar II in commemoration of his 60 Anniversary and the circulation of the same between his “mathematical friends”

This letter is a meeting point between two characters that, despite the distance, shared an interest in the diffusion of the results and were aware of the importance of communication between peers; in this work we will analyze the convergences between these two figures.

To understand the context in which the letter of Vicente Fernandez is framed, we will begin with a general overview of the work of the mathematicians in Mexico at the end of the 19th century and the work of Fernandez in the meteorological observatory along with his particular formation.

Later we will analyze the project of Fernandez on the creation of a scientific journal that would allow the state school of Guanajuato to create agreements with other journals so that students could have access to international articles.

Thereafter, we will talk about the work of Mittag-Leffler in the development of his journal *Acta Mathematica* and the role it played in the dissemination of ideas, in order to finally confront these projects and highlight their meeting points.

Mathematics in Mexico sXIX; Vicente Fernandez; Mittag-Leffler

Chaim Samuel Hönig's contributions to the development of Mathematics and the Mathematical Community in Brazil

Mariana Feiteiro Cavallari, Federal University of Itajuba (Brazil) - UNIFEI

This research aims at analyzing Professor Chaim S. Hönig's (1926 -) contributions to the development of Brazilian Mathematics. In order to achieve this goal, his academic career is investigated, with emphasis to his main works, his Scientific Lineage, and his contributions to the creation and development of the Brazilian Community of Mathematics. Professor Hönig obtained a degree in Mathematics and Physics from the Faculty of Philosophy, Sciences and Letters of the University of São Paulo – USP, where he also carried out his doctoral studies and became an Associate Professor. He worked at USP for over four decades, teaching at both undergraduate and graduate levels. He became, at the University, a Full Professor and created a research seminar. Professor Chaim was also responsible for important administrative tasks. He carried out mathematical investigations in various fields of Mathematics, specially in Analysis. Among his main academic works, three books in the Analysis field, which are broadly used in the teaching of mathematicians in Brazil. His Scientific Lineage is formed by more than 90 scholars who either work or have worked at important higher education institutions in Brazil and have carried out investigations in the areas of Mathematics Education, the History of Mathematics and, specially, Analysis. Professor Hönig was important for the improvement of communication among scholars who carried out research in Mathematics in Brazil. He idealized and created the first edition of the Brazilian Colloquia of Mathematics. He was a founder and the first president of the Brazilian Society of Mathematics (SBM). Hönig was also the first chief editor of SBM's journal. During the 1960's and 1970's, he was a member of the commission in charge of the organization of various scientific events, mainly in the area of Analysis. His participation was

significant in the creation of the first editions of the Brazilian Seminars of Analysis (SBA). In this sense, Professor Hönig's role in the creation of a Brazilian Mathematical Community of Analysts is considered to be relevant. Due to the fact that this scholar has participated in the education of mathematicians, elaborated scientific manuals, and helped make communication amongst mathematicians in Brazil more effective, it can be affirmed that Professor Hönig has also contributed to the development of the Community of Mathematics in Brazil.

History of Mathematics in Brazil; Brazilian Mathematics Community; 20th century; Faculty of Philosophy, Sciences and Letters of USP

Lino de Pombo and The Colejio Militar

Yolima Alvarez, Universidad Distrital Francisco Jose de Caldas
Asdrubal Moreno, Universidad Distrital Francisco Jose de Caldas

This work presents some aspects of the life and work of Lino de Pombo O'Donnell (1797 - 1862), who was working as a teacher at the University of Cauca and the Colejio Militar of Bogota. We will consider the influence of Spain and France in his academic training, his work experience and the education offered in the Military College. In addition, Don Lino wrote Discourses of great interest and textbooks of Mathematics, of modern character in his time.

Lino de Pombo, Mathematics, Colombia, 19th Century

027. The resurgence of applied mathematics 1850-1950: national and international, academic, industrial and military contexts

J. C. Fields, Applied Science and Canadian Government Support of Mathematics 1915-1930

Craig Fraser, University of Toronto

When John Charles Fields arrived at the University of Toronto in 1901 he was an experienced mathematical investigator with an international reputation. His research on algebraic functions reflected the tenor of advanced mathematics of the period, which was highly theoretical and unrelated to applications. As Fields career unfolded he became an advocate for both the public and private support of science. The experience of World War I led many Canadian scientists and university leaders to call for support of scientific research on the grounds of the importance it was said to hold for both national defense and industry. Fields was a prominent academic figure who engaged in such advocacy. Given the abstract and abstruse character of his contributions to mathematics, this position may seem curious. Fields was to some extent aware of its incongruity. He was the primary organizer of the International Congress of Mathematics, held at the University of Toronto in 1924. In his opening address to the congress Fields proclaimed that it brought together “the mathematician whose occupation it is to spin fine webs and elaborate beautiful configurations in the realm of the subjective and the applied man who takes all the risk of assuming that over against the subjective network presented by the mathematician there is something corresponding to the external universe. “ The paper will explore Fields public advocacy for government and industry support of science as it developed against the background of his involvement in research mathematics of the period.

The diffusion of nomography in civil engineering and industry (1900-1950)

Dominique Tournes, University of La Reunion

In an inventory published in 1950 - entitled *An Index of Nomograms* - Douglas Payne Adams collected 700 references on nomography, organized in 21 sections covering all sectors of engineering and industry: chemistry, electricity, hydraulics, aeronautics, building, mining, etc. This inventory testifies that nomography, a new discipline in applied mathematics created from scratch by some French engineers in the last decades of the 19th century, diffused rapidly to other countries and became an important tool for economic development in the first half of the 20th century. The talk will analyze this process of diffusion in an international comparative perspective, and will study in what sense nomography transformed calculating practice in public and private laboratories before being replaced by electronic calculators.

Nomography - Applied Mathematics - Engineering - Industry

Felix Klein's initiatives for transforming applications of mathematics into specialised disciplines

Gert Schubring, Universidade Federal do Rio de Janeiro

As is well known, one had since long time distinguished between pure mathematics and applied mathematics. Yet, this distinction meant a systematisation and classification of knowledge, as documented by the Prospectus of the Encyclopédie ("applied mathematics" appeared explicitly in a textbook by A. Kästner in 1759). Before the 19th century, the distinction did not mean a specialisation of one's mathematical activities. The practices of mathematicians did not use to be restricted to one of these fields. Felix Klein used to emphasise Gauß as the emblematic mathematician uniting pure and applied mathematics. But these qualities corresponded more to the reality of the 18th century – Klein's pleas signified rather a strategic manner to revive research and teaching on applied mathematics in his times.

Differing institutionalisation of pure and applied mathematics had occurred for the first time in Prussia: at the universities founded there from 1810, two chairs for mathematics were established: one for pure mathematics and one for applied mathematics. It proved, however, that this transposition from systematising knowledge to institutional reality at universities was premature. The second chair, for applied mathematics, did not enroot – applied mathematics did not become a genuine sub-discipline. One of the reasons for this was that pure mathematics experienced its take-off by the nature of scientific teacher education it had to practice in Prussia (Schubring 1991). Klein therefore conceived of to provide applied mathematics with an analogous professionalising fundament; he succeeded in convincing the Prussian Ministry to introduce in 1898 a second teacher license, for applied mathematics. While this second license exerted an important impact upon the disciplinary development of mathematics, it clearly did not function in an as analogous manner. The various aspects revealing the complexity of the further development and institutionalisation of applied mathematics within German higher education will be analysed.

References

Gert Schubring, *Die Entstehung des Mathematiklehrerberufs im 19. Jahrhundert. Studien und*

Materialien zum Prozeß der Professionalisierung in Preußen (1810-1870). 1991.

Gert Schubring, "Pure and Applied Mathematics in Divergent Institutional Settings in Germany: the Role and Impact of Felix Klein", *The History of Modern Mathematics. Volume II*, eds. David Rowe et al. (1989), 171-220.

applied mathematics, Felix Klein, institutionalization, teaching licenses

Sources for introducing social insurance to the Latin America: Emil (Emilio) Schoenbaum and Czechoslovak actuarial mathematics

Jan Kotulek, Technical University of Ostrava

In early 1940s, social insurance systems in many countries of Latin America came through rapid development. It was facilitated through abilities of émigrés from the Nazi occupied Europe. Even if the roots of this reforms can be traced back to 1930s, when Czech jurist Osvald Stein (1895–1943), head of the Social Insurance Section at the International Labour Office (ILO), visited personally the region, focus of ILO activities gradually turned to Latin America and the immediate stimulus is connected with Nazi rule over Europe and moving of ILO from Geneva to Montreal.

Thanks to Stein's efforts, Emil Schoenbaum (1882–1967), professor of actuarial mathematics at Charles University in Prague and one of the directors of General Institute of Pensions in Prague, Czechoslovakia, came to Quito, joined Instituto Nacional de Prevision in December 1939, where he was made responsible for performing necessary actuarial work and training the staff in administrative duties.

Schoenbaum, who studied pure mathematics in Prague and actuarial mathematics in Vienna and Göttingen, was the author of financial system in the broad Czechoslovak social insurance legislation, one of the mostly developed system in the whole world. He also possessed necessary experience from a similar mission, reform of social insurance in Greece (1930), international renown and had broad overview of the field, as editor-in-chief of the Czechoslovak Journal of Actuaries. In March 1939, he was forced to leave his position at Charles University in Prague by the Nazis due to his Jewish descent and asked for premature superannuation from the General Institute of Pensions, as he would be forced to leave anyway. In October he succeeded to emigrate from occupied Prague and worked for Ecuadorian and later also for Bolivian, Mexican, Costa Rican and Chilean Governments up to 1943, when he joined ILO headquarters in Montreal. After accidental death of Stein in December 1943, Schoenbaum presided the section on social security at 26th ILO Congress in Philadelphia in April 1944.

In 1948, after the communist coup d'état, Schoenbaum accepted an offer from Mexican government and joined Instituto Mexicano del Seguro Social (IMSS). Three years later, he had been accused of hostile behaviour to the "peoples' democratic" (understand communist) regime in Czechoslovakia. Therefore, he accepted Mexican citizenship and served in IMSS up to his death.

actuarial mathematics; social insurance; Emilio Schoenbaum

"An exquisite machine": Olaus Henrici's harmonic analyser

June Barrow-Green, The Open University

On 2 May 1894 Olaus Henrici, Professor of Mechanics and Mathematics at the Central Technical College, South Kensington, exhibited a harmonic analyser at the Royal Society's conversazione. It was the culmination of work begun several years earlier at University College London, prompted by an idea of his friend and fellow professor, William Kingdon Clifford. In this talk I shall describe the

development of Henrici's analyser—from the point of view of both man and machine—and look at some of the ways in which it was used.

Henrici, harmonic analyser, Fourier series

Changes in the historical triangle of graphical/geometrical methods, numerical analysis, and mathematical instruments in the decades before WWII

Reinhard Siegmund-Schultze, University of Agder, Kristiansand

Within applied mathematics there was a historical gradient pointing away from geometrical towards numerical methods and in mathematical instruments from geometrical/analogous to numerical/digital ones. The talk describes how these trends were influenced both by interaction of mathematics and its technological hardware, and by changing needs in mathematical engineering and other new professions. In particular it will be shown how these trends were reflected in the developments of the consecutive schools for applied mathematics under Carl Runge in Göttingen from 1904, and Richard von Mises in Berlin from 1920. Parallel tendencies abroad, in particular in the U.S., Great Britain, and Scandinavia are also considered.

geometrical/graphical, and numerical methods; mathematical instruments; Carl Runge; Richard von Mises

On the Impact of Desktop Mechanical Calculators on the Development of Numerical Analysis

Rita Meyer-Spasche, MPI for Plasma Physics (IPP)

Several mechanical calculating machines were constructed in the 17th and 18th centuries. They did not work, or not very well. The first mass produced calculating machines were the 'Thomas Arithmometres' from Paris (1500 machines in 1820-1878). They were useful, but no economic success. One of those was bought by Felix Klein during his stay in Erlangen (1872 - 1875). Very successful were the revised machines designed by the Swede Willgodt Odhner (1845 - 1905) in 1876. From 1886 on, many thousands of them were produced in several European countries. The German version was named Brunsviga. Douglas Hartree (1897-1958) at University of Manchester owned a Brunsviga. When these machines became available, they opened new possibilities and thus influenced economy, engineering and mathematics considerably. In mathematics, existing algorithms could be performed with less effort. This allowed to tackle new and bigger problems. Also, new algorithms were invented which are considered very important today.

As an example we describe the ground-breaking numerical work in Hartree's 'Magnetron Group' which consisted of Hartree and three co-workers with three mechanical desktop calculators. This work could not have been done without these machines. It was pioneering both in applied mathematics/electrical engineering and in computing, and it was an essential contribution to winning WWII.

We will also list several Firsts: First university course, first text book on numerical methods, etc.

Today's names for the theory of numerical methods and computation were introduced shortly after 1950: by Hartree's book 'Numerical Analysis' in 1952 in Britain and Householder's book 'Principles of Numerical Analysis' in 1953 in the US; and internationally by the journal 'Numerische Mathematik' (Springer Verlag) in 1959 (20 co-editors from 10 countries).

Applied mathematics at the periphery of Europe around 1900: a brief overview of Norwegian traditions in geomagnetism, statistics, meteorology and astronomy

Rolf Nossun, University of Agder

Neither its remote location at the northern fringe of Europe, nor the contortions of its path towards political independence from its Scandinavian neighbors, prevented Norway from making bold advances, and sometimes leaving significant marks, in the history of applied mathematics in the 19th and early 20th centuries. The overview presented here starts with Christopher Hansteen, whose interest in geomagnetism took him to Siberia 1828-30 in search for the Earth's second magnetic axis [1], but also paved the way for the celebrated research of Kristian Birkeland, Carl Størmer and Lars Vegard into the Aurora Borealis. Vilhelm Bjerknes, the founder of the Bergen School of Meteorology, laid the foundations for modern weather forecasting. Enok Palm contributed further insights into atmospheric convection and circulation. The polymath Ole Jacob Broch, author of *Lehrbuch der Mechanik* (1854) and founder of an insurance company which is still in business, became the third director of the International Bureau of Weights and Measures in Sèvres in 1879. The first director of the Norwegian Central Bureau of Statistics, Anders Nicolai Kiær, was a pioneer of representative sampling methods at the end of the 19th century. The first Nobel laureate for Economic Sciences, Ragnar Frisch, coined the term econometrics[2] for the discipline emerging between mathematics, statistics, and economics around 1925. It is also worth noting that the ubiquitous Romberg method of numerical integration was developed while Werner Romberg was in Trondheim.

[1] then thought to exist, cfr e.g. *The Philosophical Magazine and Journal*, vol 67, 1826, pp 114-124 and 167-178.

[2] adapting the German word "Ökonometrie", previously used in the sense of book-keeping

Applied Mathematics; 19th and 20th centuries; Norway

The beginnings of IMPA at the crossroads of different mathematical cultures

Tatiana Roque, Universidade Federal do Rio de Janeiro

Around 1950 several institutions were created in Brazil with the aim of bolstering economic development, with science and technology in the forefront: CBPF (Brazilian Center of physical researches), CNPq (National Council of scientific and technological development) and, attached to the latter, IMPA (Institute of pure and applied mathematics). More exactly, CBPF and IMPA owe their existence to a small group of scientists who were able to convince the government to create institutions independent from the university. Economic, energy-related and military motivations are often evoked to explain the success of this initiative, but they seem to us insufficient to explain the privileged place granted to mathematics in these political projects. The role of physics is easier to understand, given the importance of nuclear physics in the national project. But the mathematics produced in IMPA in its early years was not related to this physical domain.

In the 1940s and 1950s, the practice of Brazilian mathematics was very much marked by the visits of French mathematicians such as André Weil, Jean Dieudonné and Laurent Schwartz. Consequently Brazilian mathematicians had to take a stand with regard to the mathematics of Bourbaki. At IMPA, until the end of 1960s, two names stand out: Leopoldo Nachbin and Mauricio Peixoto. The former, recognized by his works inspired by Bourbaki, left IMPA in 1971. His departure marked a change of

direction, and dynamical systems, with which Peixoto's name is strongly associated, developed to become the main domain of research at the institute. Based on interviews and analyzing IMPA's archives, we can observe there was a silent quarrel around the various ways to generate mathematics that we can call different mathematical cultures.

Our goal is to analyze the changes relating to a shift in Brazilian intellectual ambience, from a domain influenced by France to a domain influenced by the USA. In the talk, the development of dynamical systems is then studied from the perspective of investment politics in applied mathematics. Even if the domain of dynamical systems is now considered to be pure mathematics, in that time, when compared to Bourbaki settings, it opened the path to a mathematical culture more connected with contemporary trends in research, including applied mathematics. The new institute wished to represent this kind of mathematics, in order to distinguish itself from the university and to survive as an independent institution.

Dynamical systems; IMPA; Bourbaki in Brazil; mathematical cultures

Mathematics, Optics, and Medical Technology at the Carl Zeiss Company and Their International Context, around 1900

Tobies, Renate, Friedrich-Schiller University Jena

This paper is based on newly available material concerning Moritz von Rohr (1868-1940), who studied mathematics, physics and geography at the University of Berlin, completed his doctorate in mathematics under Georg Cantor (1845-1918) in Halle, and married a British woman from London. In 1895, Moritz von Rohr joined the Carl Zeiss Company in Jena, where the physicist and mathematician Ernst Abbe (1840-1905) had conducted optical research and based the manufacturing of optical lenses on mathematics. Abbe created a mathematical department ("Rechenstube") at his Company, and in 1899 he chose Moritz von Rohr to lead it.

My aim will be to demonstrate that Moritz von Rohr generated new optical theories, instruments, and a number of patents on the basis of mathematics. The particular focus will be on his new theory of eyeglasses, which was inspired by the insights of Rudolf Straubel (1864-1943), who succeeded Abbe as the managing director of the Carl Zeiss Company. In January of 1908, Straubel visited the Bausch & Lomb Optical Company in the United States, which had been cooperating with the Carl Zeiss Company since 1892. He saw that eyeglasses there were still being produced with the trial-and-error-method. As a researcher with a doctorate in mathematics, Straubel thought that eyeglasses could be produced more effectively on a theoretical basis. Back in Jena, Straubel delegated Moritz von Rohr to implement his new ideas.

Moritz von Rohr solved the problem by travelling to Sweden and Great Britain to inspect new developments there. Especially fruitful was his cooperation with Allvar Gullstrand (1862-1930), a Swedish ophthalmologist, optician, and good mathematician. Gullstrand received the Nobel Prize in Physiology or Medicine in 1911, an award for which he acknowledged von Rohr's contributions.

Industrial mathematics; International scientific relations

The mathematics of aeronautical engineering in Britain as described in contemporary British journals and newspapers, 1900 – 1920

Tony Royle, The Open University

"Mr Hume-Rothery's work has the greater importance in that it treats the question [of negative wing tips for stability] with the proper regard to the fine mesh of the mathematical net that one expects from a Cambridge wrangler."

This editorial comment from Stanley Spooner in 1913 appeared in the January 18th edition of the *Flight* journal as part of his response to a highly technical article by Joseph Hume-Rothery carried in the same copy. The advent of fixed-wing, powered aircraft during the first decade of the 20th century had stimulated a demand for mathematicians to investigate, nurture, and debate the new discipline of aeronautical engineering. Many of these deliberations and exchanges were presented to the general public in Britain through various reports, articles and commentary in a plethora of contemporary publications, such as *Flight*. In this talk I will discuss the nature and extent of this narrative.

Aeronautics; Engineering; Journals; WW1; Britain

028. Multiple Spaces: Mapping Communication via Letters between Naturalists

Aims and impact of correspondence networks on the scientific and intellectual activities of François Crépin (1830-1903), famous rhodologist and Director of the State Botanic Garden of Belgium

Denis Diagre-Vanderpelen, Botanic Garden Meise / Université Libre de Bruxelles
Ivan Hoste, Botanic Garden Meise

This contribution will put the focus on a major Belgian botanist of the 19th century – François Crépin – and the vast amount of incoming correspondence he left. Although he was not a formally trained botanist, he managed not only to dominate the national scene of floristics, but also to make a name for himself as a specialist in the complex genus *Rosa*, to control the activities and publications of the Royal Botanical Society of Belgium and its relations with counterparts and botanists abroad, and, last but not least, to run the State Botanic Garden during a 25 years long period of time. François Crépin's rise to scientific recognition was built on a frantic correspondence with botanists from all kinds and spaces he would probably never see. Depending on the stage in his career and on the related project he had in mind – his famous handbook of the Belgian flora or his never-to-be-released world monograph of the genus *Rosa* – he corresponded with local naturalists or with savants who more often than not were active outside the growing new scientific establishments of academically trained researchers. In a nutshell, Crépin built his career on strategic and carefully maintained botanical networks that allow historians to follow the man's professional cursus and his personal intellectual evolution from his original phytographic oriented work to more challenging works on the systematic of a puzzling botanical group. In their contribution, the authors will depict how François Crépin built, used, fed and, sometimes, massaged his correspondence networks and how it impacted on his research projects in material or intellectual ways.

"XIXth century" "network" "career" "professionalization" "botany"

Fragments of a Distant Land: Johann Natterers Letters from Brazil, 1817-1835

Kurt Schmutzer

When the Austrian expedition to Brazil started in 1817 in the wake of Archduchess Leopoldina's marriage to Dom Pedro, crown prince of Portugal, letters, like in other well-known scientific voyages of the period, played a crucial role in organizing and conducting the tasks of travelling naturalists and painters. Beyond the exchange of scientific issues letters were the naturalist's lifeline to financial, intellectual and emotional support. In the case of the zoologist Johann Natterer the lack of other sources like diaries or a travelogue make his letters the main information about his proceedings throughout 18 years of travelling in Brazil and collecting specimens for the Imperial cabinet for Natural History in Vienna. They offer vivid insights into Natterer's life as a naturalist, but also throw a light on the significance of letters in the context of the expedition in a broader perspective. Natterer's messages mediated between spaces of knowledge, between "field" and "museum", between the "wilderness" of Brazil and the specimens, displayed later on the shelves of the Imperial cabinet. They mediated between his locally acquired experiences and – as he certainly saw it – the global enterprise of Natural History, which was to contribute to a complete and universal taxonomy of the world's flora and fauna.

Letters certainly could only relate summaries of all the information and experiences which the naturalist acquired. Together with drawings, transport lists, identification labels and the specimens collected, these letters created new knowledge and an up-to-date, but inevitable fragmentary idea of "Brazil" and its "nature".

According to the official instruction for the expedition Natterer was not free to communicate with other scientists, but restricted to his superiors. Mandatory and regular writing of reports appears as an instrument of control over the body of the traveling naturalist, his discipline and his duties, as well as over his mind and the transfer of knowledge.

Limited and fragmentary as they were, these letters were evidence of the expedition's progress, effective means to make claims to discoveries in Natural History and to declare the expedition a success, both in public opinion and towards competitors within the scientific community.

Natural History; Zoology; Museum; Communication

Geological correspondences in an 18th century scientific journal: the *Giornale d'Italia* (1764-1796)

Ezio Vaccari, University of Insubria

The aim of this paper is to analyze and evaluate the emergence of new scientific studies related to geological, mineralogical and paleontological subjects in the pages of an Italian scientific periodical, the *Giornale d'Italia*, edited in Venice from 1764 to 1774 by the naturalist Francesco Grisellini and later, up to 1796, by the geologist Giovanni Arduino. During these three decades, one of the main tools for promoting the study of geological sciences in the journal was the regular publication of letters (single or series), written or received directly by the editors, but also often selected from the unpublished correspondence between Italian and European scientists who were among the collaborators, subscribers or readers of the *Giornale*. The result of this survey reveals the existence of a network of scholars, studies, travels and fieldwork within a lively community of naturalists, mineralogists and 'oryctologists', mainly based in the Venetian region of northern Italy. Some of the most significant travels, carried out in several regions of Italy, but also in central and eastern Europe, became part of a literature called "odeporica" (odeporic), which combined scientific and naturalistic elements with technical, anthropological and socio-political issues. The *Giornale d'Italia* can also be regarded as a very significant source for evaluating the early development of geological communication in Italy: but it is also an interesting example of how letters

ICHST
2017

were used outside their original context, in order to emphasize the importance of the newly emerging science of geology in the late 18th century Europe, both for practical and scientific reasons.

history of geology; journals; letters; Italy; 18th century

Antonio Vallisneri (1661-1730) and the Rise of Naturalistic Experimentalism. A European Debate

Francesco Luzzini, Max Planck Institute for the History of Science

Early modern science is as much about theories as it is about communication and exchange of information and objects. With respect to the early Eighteenth century, a striking proof of this assertion is provided by the European-wide correspondence of Antonio Vallisneri (1661-1730), professor of medicine at the University of Padua and member of the Royal Society of London. Vallisneri was the dominant Italian figure of his time in the field of medical and natural sciences. It was by appealing to shared experimentalist values that he came into contact with an astounding number of scholars throughout Europe: by endorsing a view of science as a collective and cumulative enterprise, he himself became the center of an epistolary network which involved scholars of the likes of Johann Jakob Scheuchzer, Frederick Ruysch, Louis Bourguet, Luigi Ferdinando Marsili, Martin Lister, Thomas Dereham, Hans Sloane, Gottfried Wilhelm Leibniz, and many more. Since 2000, the National Edition of Antonio Vallisneri's Works (www.vallisneri.it; <http://www.olschki.it/la-casa-editrice/collane-Olschki/edizioni-nazionali/edizione-nazionale-Vallisneri>) has carried out many important studies, critical editions, and digital humanities projects, asserting itself as one of the most lively, advanced, and renowned institutions of this kind. An integral part of this project is the electronic inventory of Vallisneri's correspondence (<http://www.vallisneri.it/inventario.shtml>), which holds over 12,000 letters, 2,700 transcriptions, and 1,200 manuscript scans. In light of its importance, the inventory has recently joined the ISCH COST Action IS1310 – "Reassembling the Republic of Letters, 1500-1800", a digital framework for multi-lateral collaboration on Europe's Intellectual History (<http://www.republicofletters.net/>). Given the extent of its geographical and intellectual range, Vallisneri's correspondence offers a wealth of information to better understand how the Italian tradition of Galilean experimentalism and natural philosophy interacted all over Europe, and how this interaction – and, therefore, the transmission and reception of data and ideas across national, social, institutional, political, and confessional boundaries – was crucially shaped by different geographical settings. Case studies will feature the hydrogeological debate, the use of microscopy, the organic origin of fossils, diluvialism, geochronology and the discovery of deep-time, medicine and the search for new therapeutics.

Republic of Letters; Communication; Digital Humanities; Topography of places; Antonio Vallisneri

Mapping Narratives, Making Politics: Discourses on Space and Identity in the Correspondence of the Serbian Geoscientist Jovan Cvijić

Johannes Mattes, Department of History, University of Vienna

Life and work of the geographer and geologist Jovan Cvijić (1865–1927)—in later years rector of the University of Belgrade and president of the Serbian Academy of Sciences—are embedded in the context of scientific nation building and ethnic geopolitics in pre- and post-war Europe. As one of the most powerful scientific consultants engaged with the demarcation of South-Eastern Europe's state borders at the Paris Peace Conference of 1919, Cvijić both introduced and combined physical,

cultural, and social concepts of space to design a spatio-symbolic “order of the floating mass of Balkan people” in form of an own “Yugoslav civilization”.

Written mainly in French, English and German, Cvijić’s huge correspondence, sent from changing locations on his extensive fieldtrips to scholars all over the world, became a meta-instrument for the determination of a fictional, representative topography. This specific spatial setting or mental map, which was generated through the circulation of letters, attached objects, and scientific concepts, stood in stark contrast to his geopolitical image of Serbia as a state of transitional position and exposure. From this aspect, Cvijić’s letters dealt with multiple layers of topographical meaning, which were continuously reinterpreted and transformed in form of “spatial stories” (Michel de Certeau), communicating his fieldtrip observations to other scholars.

Disentangling these different layers of spatial reasoning and argumentation, the paper examines Cvijić’s letters as a representation of physical, social or cultural space, but in particular as a space of representation, where modern discourses on geopolitics, geosciences, and identity interacted. Sources for this research comprised Cvijić’s scientific papers and selected extracts of his correspondence stored in the archives of the Serbian Academy of Sciences and the Austrian National Library.

letter; geoscience; politics; space; narratives

Science in Exile: Natural History and the Hungarian Emigration Network in Correspondence, 1849-1867

Katalin Straner, European University Institute

Correspondence is doubtlessly a crucial medium of communication, the importance of which in history and the history of science has been shown to illustrate how far the networks that used to facilitate the circulation of scientific knowledge reached out to the scientific community and to a wider audience (P. White, 2008). This paper engages with the spatiality of communication and the circulation of scientific knowledge through studying the correspondence networks of Hungarian natural scientists in exile following the fall of the Revolution and War of Independence in 1848-49. The paper will focus on the role of the Hungarian émigré community as “cultural brokers”: serving as a bridge in communicating, through correspondence and publications, the latest developments in British science and culture, thus making a “career out of their displacement” (P. Burke, 2011). The primary source material for the analysis is the extensive correspondence of Jácint Rónay, a Benedictine monk and natural scientist — considered to be among the first Hungarian Darwinists — who lived in London for sixteen years and whose known recollections attest of carefully maintained connections not only to the Hungarian scientific community, but also to newly built networks in London, including the Royal Geographical Society or the British Association for the Advancement of Science. Rónay’s letters to the members of the Hungarian émigré network, as well as to old and new colleagues and acquaintances in Hungary and in Britain offer valuable insight into the negotiation of scientific knowledge through various spatial boundaries, as well as a novel view of the social and scholarly life of natural historians. Moreover, my research offers contrasting descriptions of his work and public reception in correspondence, diaries, as well as the popular press, with special attention to how the public and private spaces he visited are described; thus, the paper will reflect on the spatial dimensions of his work and of its public reception.

correspondence; exile; networks; Hungary; London

St. Petersburg Academy of Sciences, its correspondents and the production of space of the Russian empire in the 1760s-1790s

Marina Loskutova, National Research University - Higher School of Economics, St. Petersburg

The late 18th century was the last period of a substantial territorial expansion of the Russian state in Europe: it secured the control over the Lower Volga, took over the Crimean peninsula from the Ottoman Empire and annexed substantial territories of the former Polish-Lithuanian Commonwealth. Military conquest, however, had to be supplemented by administrative integration and symbolic appropriation of the new territories. Cartography and land surveying, exploration of the territory's natural resources were essential for making the newly acquired territories 'legible' for the imperial government. The principal institution charged with these tasks in the late decades of the 18th century was the St. Petersburg Academy of Sciences and its Geographical Department.

In the paper, we will examine correspondence between the St. Petersburg Academy of Sciences and its astronomers, cartographers and naturalists dispatched by the Academy to various places within the Russian empire with the purpose of surveying the country's territory and its natural riches. We will consider the routes of these missions and the choice of locations for scientific observations, and we will analyse the role of the imperial administration, the Academy of Sciences and naturalists themselves in the decision-making concerning the geography of their voyages. We will also consider the transformations of fictional topography, as produced by travelling naturalists in their reports to the Academy in St. Petersburg, in further correspondence between the Academy, the imperial government and the learned institutions abroad. As a result, our paper will contribute to a better understanding of the ways geography and natural history contributed to the new modes of governing space, as they emerged at the turn of the late 18th – early 19th centuries.

"Russia", "expeditions", "late 18th century"

Multi-layered Mapping in the Memory of Japanese Geologists at their Colonial Settings

Toshihiro Yamada, University of Tokyo

In the making of geological maps, generally speaking, geologists gathered data in their field works, selected them from the route-maps, and mapped out on the topographical maps. In reality, however, this typical procedure used to be supported by wider range of activities for relevant information. In case of the Japanese geologist Nakamura Shintaro (1878–1941) in Korea, investigating in the fields of the peninsula, he not only used his hammer and clinometer but also utilized the descriptions of old Korean regional geography writings. He also insisted that one should ask indigenous people about some kinds of stones that suggest deposits of resources. Thus he accomplished very useful and detailed mappings in his works for the Geological Survey. To sum up, the process would be articulated in the following multi-layered memorial system: 1st layer: geological mapping on the topographical map; 2nd layer: first hand 'sense data' memory such as field note, route-map, photos, etc.; 3rd layer: informant network including colleagues, travelers, and indigenous people; and 4th layer: published papers, old handwritten maps, and past records in regional geography books. Under this formulation, I would like to analyze the case of the Japanese geoscientist Ogawa Takuji (1870–1941), who was a geological surveyor in China and a researcher of Chinese ancient geography and natural history. Ogawa was at the same time one of the authors of the history of geology in Japanese,

ICHST
2017

tracing the 'footprints' of Alexander Humboldt and Charles Darwin in South America. Attention will be paid to how his Western and Eastern views were interwoven in such a multi-layered system.

history of geology, East Asia, geographical knowledge, memory of geologists

029. "Black Gold": History, Exploration & Exploitation of Oil and Gas in National and International Contexts

Seismic Prospecting in North America

Brian Frehner, University of Missouri, Kansas City

The seismograph was an example of a wartime technology that transformed industry after the war. Inventors who experimented sending and receiving seismic waves during World War I patented these ideas which provided the intellectual foundation for "wireless telegraphy," an invention we now call "radio." This research offered an important theoretical foundation for seismic prospecting to emerge in the early twentieth century. Informed by these ideas, a German geophysicist invented a portable seismograph to locate enemy artillery during the war and later brought his invention across the Atlantic at the behest of American oil men who employed him to use his device to search for oil in Oklahoma, Texas, and Mexico. The seismograph's utility resulted in the discovery of huge oil reserves along the Texas Gulf Coast and eventually in other locales throughout the American West and the world. Due in large part to these activities, the modern oil industry was born.

oil exploration seismograph

"Sinclair Oil Company and the Making of Dinosaur myths in the United States"

Cohen Claudine, EHESS - Paris

Dinosaurs first appeared in marketing for Sinclair Oil Company in 1930, as part of a campaign to educate customers about the origin of fossil fuels. Sinclair Oil started using the Apatosaurus as its symbol in an exhibit held in Chicago during the 1933-34 Century of Progress World's Fair. Following that success, Dino reappeared in a number of popular exhibits, such as New York World Fair in 1939 and later in 1964, while rubber copies and images of various species of dinosaurs were widely circulated and distributed to customers.

We will study the part played by this episode of American oil economy and marketing into the diffusion and popularization of paleontology, and in particular in the making of the image and myths of dinosaurs during the 20th century in the United States of America.

oil ; oil firms in XXth century America; Dinosaurs ; public diffusion of scientific knowledge ; popularization of science

Technique and exploration: the beginning of micropaleontology in brazilian oil industry

Drielli Peyerl, Unicamp

In 1953, the creation of Petrobras contributed not just for the Brazilian oil policy and economy, but also for the creation of a department focused on the exploration of oil in the Brazilian territory. Created in 1955, the Department of Exploration - DEPEX was divided in and performed by local Districts situated in basins with oil potential, all directly subordinate to the Chief Superintendent, the North American geologist Walter Karl Link (1902-1982). It is necessary to point out the importance of the investments of Petrobras, and mainly of the Department of Exploration, in the Labs of Paleontology, Stratigraphy and subsequently in Sedimentology. In the 1950s, the first Paleontology Labs were situated in Belém (PA), Ponta Grossa (PR) and Salvador (BA), and incorporated by these Districts. Huge advances in scientific and technical expertise related specifically to micropaleontology were achieved. Professionals of the company performed their activities during this period, in particular the Brazilian paleontologist Frederico Waldemar Lange (1911–1988), who started developing the first studies on microfossils in 1955, mainly chitinozoa. From 1958 onwards, we also have in the lab in Belém, the Danish J. C. Troeslen and the paleontologist Karl Krömmelbein, who continued their researches on foraminifera from the coastal basins in the North and in the Northeast. The activities of the professionals continued to expand, contributing significantly to new oil discoveries. Since the beginning, Petrobras invests in the qualification of his own labor force with courses and internships abroad. As two specific examples we have the Advanced Course in Micropaleontology, offered by the “Centro de Aperfeiçoamento e Pesquisas de Petróleo” - CENAP/Petrobras (Improvement and Oil Research Center), in 1961, with 6 months of duration and the internship in Micropaleontology (foraminifera and Nano fossils, in oil companies abroad), in 1968. Thus, this summary confirm the first steps of the paleontological researches, highlighting the technic and scientific improvements of Micropaleontology in the Brazilian development of oil exploration.

Micropaleontology, Oil, Petrobras, Brazil

Rutherford's Practical Geophysicists: Patrick MS Blackett and Teddy Bullard, Reconsidered

Gregory Good, American Institute of Physics

This talk re-frames the discussion of two physicists trained by Sir Ernest Rutherford, who is not well known as a geophysicist and certainly not for his connections to the mineral industry. Nevertheless, both of these students of Rutherford went on, first, to become active in geophysical research, and second, to play important roles in bringing techniques important in exploration geophysics into the mainstream of academic geophysical research. This story is just one of many needed to address general questions of the relations of private and public geophysics in the 20th century.

physics; geophysics; seismology; geomagnetism

From Local to Global: The Petroleum Geologist Hans Höfer von Heimhalt between Empires, Economies and Epistemologies

Klemun Marianne, Department for History, University of Vienna

Scientists often use local dimensions as a starting point to transfer their insights to a global or general level by applying a complex transformation process. Historians of science today are aware of this phenomenon and give more attention to a broad range of intermediate and interconnected levels and aspects such as empire and state, as well as to their dynamics between economy and state and relations to each other.

The paper focuses on three main works by the Austrian/Bohemian Hans Höfer von Heimhalt published in 1877, 1888 and 1909 to 1919 – that is when petroleum geology came into being. They were often reprinted and translated in several languages. When von Heimhalt died in Vienna (Austria) in 1924, the American Association of Petroleum Geologists, founded in 1917, celebrated him as the most eminent European petroleum geologist.

Trained at the Mining Academy in Leoben (Styria), von Heimhalt was professor of Geology at several mining academies of the Austrian empire. His interest in petroleum began in North America and with a local perspective when the Austrian trade ministry commissioned him to visit the world exhibition in Philadelphia in 1876. After his visit he published his first paper on petroleum in North America (1877), in which he established his anticlinal theory on the causes of the origin and the formation of petroleum based on regional findings, which he expanded in 1888.

Within the borders of the Habsburg Empire petroleum was first discovered in Galicia (today Ukraine) around 1810 and mainly used as fuel for lighting. Although this industry proved to be highly successful, the Habsburg Empire initially rather ignored it and did not order an extended geological survey until World War I. Nevertheless, in the 1870s Austria emerged into the third largest petroleum producing economy after Russia and the USA. Höfer intensified his research and edited five volumes on global petroleum deposits (1909-1919).

Höfer's contributions in the field of petroleum geology reflect the shift from local surface indications to systematically applied petrology, sedimentary, stratigraphy to the search for hydrocarbon accumulations. Modern exploration methods and a worldwide mapping of all oil deposits known showed the global interest in this matter and the close connection between theory and practices, field-geology and experiments.

Höfer von Heimhalt, Petroleum Geology

Petroleum and Alcohol: new energy perspectives for Brazil in 1922

Maria Margaret Lopes, Universidade de Brasília

The 1st Brazilian Congress of Coal and other National Fuels was held in 1922. It was organized by the Experimental Station of Fuels and Ores connected to the Geological and Mineralogical Service of Brazil. The Congress consisted of a broad discussion about the economic exploitation of coal in Brazil, the already investigated possibilities regarding the existence of petroleum, the importance of oil shale and the use of alcohol as fuel. Such strategic national resources for modernizing industrial projects, stimulated by World War I, had already been the objects of systematic research by geologists, engineers and technicians of the Geological and Geographic Commission of São Paulo since the late 19th century.

In the case of petroleum, the experts presented some studies on its origins and the various investigations in progress on oil prospecting. As for alcohol, its energy and industrial use was one of the key items on the program of the researchers of the Experimental Station, which would later develop the first car to run on alcohol in the country.

This article presents aspects of the discussions and resolutions on petroleum and alcohol in that Congress. It considers the Congress as an important mechanism to trace the conceptual frameworks related to the discussions on the circulation of knowledge and technical and scientific practices regarding the origin and exploitation of petroleum. The article argues that this Congress was one of the legitimizing strategies of the research and effective actions by the group of scientists and technicians associated with the Geological and Mineralogical Service of Brazil, in its dialogues with the State and business groups. These strategies were focused on strengthening the geological investigations regarding the energy resources of the country.

"Oil"; "Alcohol"; "Congress"; "Brazil"

The history of oil exploration in the State of São Paulo before the foundation of Petrobras (1872-1953)

Silvia Fernanda de Mendonça Figueirôa, University of Campinas - UNICAMP

Julia Chinellato Tulimoski de Oliveira, ARANZ Geo Limited

This paper intends to bring to light a still poorly known history, which demonstrates the technological and intellectual momentum of the geology of the State of São Paulo, before the creation of Petrobras. Although the results regarding the presence of oil in significant amounts were disappointing, relevant geological results were achieved, as well as technical advances.

The initial steps of oil exploration in the State of São Paulo were linked to private entrepreneurs, and date back to the year of 1872. Since the beginning, exploration and research attempts took place in the hinterland localities of Morro do Bofete and Águas de São Pedro, through geological studies performed by important naturalists, engineers and geologists.

In the 1920s, surveys were performed by the Geographical and Geological Commission of São Paulo (CGG), in cooperation with the Brazilian Geological Survey (SGMB). A special subdivision was created within the CGG in 1926, namely the Oil Department, and the North American petroleum geologist Chester Wesley Washburne (1883-1971) was expressly hired in 1928.

During the historical period called "Estado Novo" (1937-1945), the federal government continued to conduct explorations, along with the private initiatives by the writer Monteiro Lobato, a strong critic of governmental action.

The set of documentation used includes private and official letters, besides other types of historical documents, in custody of the Historical Archives of the State Geological Institute of São Paulo.

Oil; São Paulo; History of Oil; History of Geosciences; Chester Washburne

030. History of Tourism: What Can the History of Technology Contribute?

Remembering the Industrial Revolution

Barbara Hahn, Texas Tech University

In the 1960s and 1970s, just as the textile industry was abandoning its original location for sources of cheaper labor around the world, many of its sites became museums of industrial heritage. From Styal at Quarry Bank (where the Greggs built a spinning mill in the eighteenth century) to the Queen Street Mill in Burnley (where a workers' cooperative saved jobs for weavers a generation longer than many of its neighbors), old textile mills became museums.

The interpretations offered by these mill museums were characteristic of their time. Social history

dominated the interpretations offered by professional historians, and labor fought against the conservatism that would become Thatcherism. Today, austerity policies are closing many of the old mill museums. Attendance, however, has been falling for even longer. Why? This paper argues that a contradictory message limits the appeal of these locations: the history of worker exploitation vies with local sorrow and resentment at the loss of industry and jobs. A history-of-technology interpretation, however—replete with questions of invention versus social construction, concerned with the networks that formed around industrialization—would provide a new way of viewing the past. It would also make history-of-technology understandings more common in the general public. This paper is based on the author's consultancy work with Manchester's Museum of Science and Industry and Leeds Industrial Museums as well as visits to Bradford Industrial Museum, Saltaire, Helmshore Mills, Queen Street and Quarry Bank, some of which are now closed.

heritage; museum; tourism; industrial revolution; labor

Touristic promotion of traditional technologies: Concepts of preserving and exhibiting underground water channels (qanāt/kārīz) in Iran and China

Constantin Canavas, Hamburg University of Applied Sciences

A traditional technique of extracting and transporting water in arid regions of North Africa and Asia is generally known as qanāt or kārīz (or other local names). It is characterised by sophisticated knowhow, high labour demand on construction and maintenance, but low-tech demand on (traditional) equipment. Such water networks – whether for irrigation or drinking – consist of underground canals leading water from the source (generally near a mountain) to the places of consumption.

The present study focuses on current “rediscovering” this technique and introducing the issue into the heritage discourse and tourism policy in countries such as Iran and PR China. In the case of Yazd (Iran) the existing underground channels which traverse the city have been made accessible to the public – albeit not in use. The rehabilitation project of the whole old town has been focused on the traditional water-and-wind issue. In the case of Turfan (Xinjiang, West China) two branches of the kārīz network have been arranged as exhibition museums for the public in the outskirts of the oasis-town, while maintaining other branches in use.

How much modern technology is needed for exhibiting traditional technology? In the case of Yazd the setting showcases the societal embedding of a traditional technology with an imaginative temporal projection in past time, while in Turfan the experience- and entertainment orientated settings focus on description of the scientific background and the technological intervention onto the natural environment – an intervention still on-going and embedded in the current economic activities of the area.

"qanāt"; "Turfan"; "Yazd"; "water"

A tourist under the Sea: did the Channel Tunnel change leisure travel between Britain and the Continent?

Laurent Bonnaud, Sponte sua sprl

The project of a permanent civil engineering structure linking England and France has been a matter of concern from the 1830s onwards, when railways and tourism developed together: by avoiding the hazards of the sea voyage, a cross-Channel fixed link would have facilitated passengers flows to and from Britain in all seasons, and increased leisure travel.

This incentive remained when Channel projects revived after WW2, up to the 1985 proposal for a twin bored railway tunnel with shuttle services for cars, selected by the British and French governments (Lille, 20 January 1986). Since the terms of the concession were a strictly private funding, detailed traffic forecasts were delivered all through the selection and financing process. Regions and capitals served by the project (Kent, Nord-Pas de Calais, Paris, London and Brussels) developed strategies to boost their attraction. Advertising shaped mutual representations. The Channel Tunnel became an icon and visitors converged to its construction sites.

Two decades after Eurotunnel was set into operation, it is worth reflecting upon its impact on individual and collective leisure travel – e.g. short vs long-range, day-trips, new destinations - as well as its growing market share versus planes and ferries. Are the Channel link's key components – tunnel, terminals, stations - established sightseeings? Sources for « Chunnel » studies are scattered between border countries, public and private institutions. Notwithstanding, a research programme initiated by RAILS et histoire assessed the many changes brought along by this specific technology combining car shuttles and high speed trains. We shall develop its conclusions on tourism and put them into perspective with the expectations nurtured by a 200-year old dream. Changes may not be as radical as forecast, but the new artefact became a magnet for visitors.

Channel tunnel, infrastructure, tourism, railways

Infrastructures of Tourist Cities. A Transnational Approach

Stefan Poser, Helmut Schmidt University Hamburg

In this paper I will study the influence of tourism on the development of tourist cities and their peculiar infrastructure. For example, the Spanish Costa de Sole developed from an economically poor region of agriculture and fishing in the 1950s to a mega city of 150 km length today. The city's environment and the city's infrastructure is designed especially for tourism. Another example is the famous British coastal resort of Brighton. In Brighton an urbanization boom took place in 19th century, when the city was connected by railway to London. The number of tourists increased tremendously, members of new strata of society visited Brighton and the city's shape changed dramatically. In both cases the development of mobility for leisure purposes had an enormous impact. Processes of rapid urbanization took place in Alps' valleys as well, when skiing changed to mass tourism since 1930s. Small villages in the no-where became well-known places of winter sports and developed into small towns. Especially the development of infrastructure for skiing meant an enormous environmental impact to the region. My aim is to compare such tourist cities, to analyse special regional and national developments and to discuss the role of technology for those cities. How influenced technical developments the urbanisation process of tourist cities? Shaped technology the city's image? In which way were experiences of travelling shaped by technology and by the built environment?

"Tourism"; "infrastructure"; "technology"; "transnational"

Exploring European Travel: The Swedish Package Tour

Thomas Kaiserfeld, Lund University

In the late 1950s and early 1960s, new patterns of leisure-travel consumption emerged in Europe. Package-tour vacations became more popular during this period, when travel technologies were shifting from the bus to the airplane, especially in the small, wealthy neo-corporative countries on

Europe's periphery—in regions like Scandinavia that were relatively unscathed by the Second World War. The argument in this presentation relies on the concepts of tourism regimes and mediation junctions to characterize and explain the shift from package tours by bus on the continent, primarily to cities and cultural as well as commercial centres, to package tours by airplane, primarily flying over most of the European continent to reach the Mediterranean coasts for leisure activities. The Swedish package tour by airplane was influenced by the U.S. in a limited, contained, and often indirect way. But the development—the way in which the consumption regime evolved—retained a resolutely Swedish, if not European, character.

history of tourism; package tour; tourism

031. West-East Transfer of Technology during the Cold War

Stabile relations with war reparations: Finland, the Soviet Union, and an international system of technology transfer, 1944-1960

Aaro Sahari, University of Helsinki

This paper discusses the techno-political dimensions of Finnish-Soviet Cold War relationship. I argue that a few key actors in Finland understood the political dimension of metal manufacturing in building a lasting, peaceful relationship between the two countries and with the cooperation of their Soviet counterparts were successful in transforming a temporary war reparation system to permanent, technocratic one.

As part of the peace terms, Finland agreed to pay war reparations to the Soviet Union in 1944. Shipbuilding constituted a quarter of the agreed upon price despite the fact that Finland was anything but a country of shipbuilders. Under pressure, the Finnish government started an unprecedented new-build program that was meant to be transitional at best. A war reparations' system was set up and eventually dismantled in 1952 having successfully managed to coax the industry into expanding production. The fundamentals of this system proved to be much more resilient though, leading Finland and the Soviet Union into a long-lasting, stabile relationship. Using the concept of large technological systems developed by Thomas Hughes and the idea of technopolitics by Gabrielle Hecht, I will analyse how this system was built, who were it's system builders, and what policies were they instigating in setting the system up. I make use of a wide set of sources from public, company and private archives in my analysis.

The paper delves a key argument of my doctoral dissertation to be finished in 2018.

technopolitics, transfer of technology, shipbuilding, Cold War, Finland

Controlling the weather...controlling the world? The mutual transfer of weather control techniques among the United States, the Soviet Union, and the People's Republic of China

Kristine Harper, Florida State University

When people refer to the arms race during the Cold War, missiles, nuclear warheads, and anti-submarine warfare commonly spring to mind. But starting in the 1950s, deliberate attempts to modify the weather—commonly dubbed “weather control”—were also being pursued for the Cold War arsenal. While most of these efforts focused on aiding or hampering agriculture, depending on

whose farmlands were going to be targeted, both the U.S. and U.S.S.R. feared that the other side was attempting to create and deploy a viable weather weapon. Coming rather late to the game in the West-East transfer of technological and scientific know-how, the People's Republic of China also entered the race to control the weather when the Communist Party convinced meteorologists that forecasting the weather was not sufficient to propel the country forward. The real fear among these countries—based on, perhaps, not-so-solid evidence—spurred all sides to allot funding for additional weather control development, thus leading to a mutually reinforcing race to control the weather.

weather control; Cold War; weapons

Construction Engineering, Architecture and Women: Women's Careers in Communist Poland

Piotr Marciniak, Poznan University of Technology

During the postwar period in Poland, women in professional careers became a standard. The intention of the communist authorities was to secure as many qualified workers as possible to support the growing economy. On the pretence of providing equal chances, the authorities encouraged women to take up the so-called “male” jobs and considerably widened the educational opportunities. Many women perceived the new professions as a synonym of higher status and social emancipation. However, the complicated political situation, the enormous economic difficulties and the promoted family model reduced most women's activity in the architectural and engineering professions to a means of making a living instead of the realisation of their creativity. In the People's Republic of Poland, the spirit of creative freedom was confined to an institutionalised framework of huge state-owned design studios and construction companies, where most of the women architects and construction engineers were employed. Only few women worked in architectural and construction administration or in higher education and research. At the same time, many anonymous hardworking women architects and construction engineers (educated mostly after World War II) worked at the state-owned companies. Their daily, extremely laborious efforts contributed to the realisation of the massive and ambitious architectural and urban planning projects in postwar Poland.

Until recently, the subject of women's involvement in the public, political and economic life of the People's Republic of Poland did not receive too much attention from researchers, whilst questions regarding women's participation in the building of the spatial environment are, so far, a genuine “uncharted area”.

Among the hundreds of women architects, only a small number achieved independence and widespread renown, and we know nearly nothing about the women engineers who worked in the construction offices and on the massive socialist projects. Whilst research conducted in the 1980s showed that women's professional activity had been growing since 1945, most of them focused on making an income and put their personal considerations regarding career development to the side. Real autonomy and equality was very rare.

In the presentation I wish to describe the achievements of women architects and construction engineers, and to show the direct links between their work and professional status, and the socio-political formula of the communist state.

women; architecture; construction; communism

Technical and scientific aspects of the Cold War: was the creation of CERN (Geneva) a maneuver by the USA to bypass French research?

Robert Belot, University of technology Belfort-Montbéliard

CERN (European Organisation for Nuclear Research), the world's biggest particle physics research centre, was founded on 29 September 1954 by a convention ratified by 12 European states. Its creation was generally presented as a major step towards Europe, towards peace and towards science. Taking the geopolitical context into account leads us to suggest new hypotheses about the real issues and secrets behind its creation.

We wish to show that CERN is a product of the Cold War, and that it tells us about a subtle mutual relationship between France, Switzerland and the United States.

A pioneer in atomic research, France created the Commissariat à l'énergie atomique (CEA) in 1945 on the initiative of Frédéric Joliot-Curie. Joliot-Curie, winner of the Nobel Prize in Chemistry in 1934, was the first to prove that nuclear fission could produce vast amounts of energy that could be transformed into an unprecedented weapon of destruction.

In 1948, France developed the first atomic pile in continental Europe. This event immediately led to fears, because Joliot-Curie, the internationally known head of the CEA, praised by Einstein, was a communist with pro-Soviet sympathies. The British and American governments launched a press campaign against him. Their aim was to circumvent Joliot-Curie, but also to restrict French nuclear research.

A year later, Europe's federalist movements decided to promote the construction of an atomic research organisation in Switzerland. We have been able to identify the presence in Switzerland of two CIA members at the inaugural meeting of what would become CERN.

Based on this revelation, we have conducted an investigation that supports a new hypothesis about the ideological motivations behind the creation of CERN. Under the cover of UNESCO, which promoted the operation, was this no means for the Americans to encourage the development of European atomic research under their control in order to counter Soviet progress in the field and get round the French obstacle?

CERN; Cold War; Nuclear research

A 'Hidden Hand' in Eisenhower Science Policy: U.S. Interest in Eastern Bloc Science and Technology

Ronald E. Doel, Florida State University

In late 1960, when President Dwight D. Eisenhower faced a choice between maintaining traditional scientific internationalism or restricting it to better support U.S. foreign policy and Western Bloc solidarity (as Department of State officials strongly urged), Eisenhower Science Advisor George Kistiakowsky waged a campaign for internationalism. Pitching his arguments at a meeting of the National Security Council (NSC), Kistiakowsky declared that international science exchanges aided not only research but also contributed to "political, psychological, and intelligence areas." These efforts, he asserted, would increase contact with the satellite countries of the Soviet Union, particularly Czechoslovakia.

Just what Kistiakowsky had in mind is not clear—to this day, part of his testimony remains classified. But other recently declassified documents suggest that scientific internationalism was meant in a much broader sense than often understood. Prior focus on the challenges to scientific internationalism during the Cold War—an important issue in its own right—has obscured significant ways that technological demonstrations and exchanges also figured prominently in the plans of Eisenhower Administration officials by the end of the 1950s. Advisors promoting internationalism, recognizing that technological advances had far more psychological impact than scientific achievements, promoted schemes for technology transfer, and worried about negative foreign reactions to science-based military

ICHST
2017

technologies that seemed to threaten global stability and the natural environment. Yet they were aware that emphasizing technology transfer encouraged domestic political hard-liners to decry scientific internationalism as risky and damaging to national security. This paper explores what amounted to a behind-the-scenes political dance: emphasis on “the independence of science from political beliefs” while simultaneously promoting East-West technological flows.

scientific internationalism, foreign policy, technological exchange

Big and Small. Finnish-Soviet scientific and technological cooperation in Arctic Maritime technology during the Cold War

Saara Matala, Aalto University

In the Cold War technology was transferred and even co-developed across the Iron Curtain through multiple channels and this was supported by various actors with their diverse rationales. The paper investigates east-west technology transfer as a multidimensional process through a case study of the Finnish-Soviet “Arctic-project,” a bilateral cooperation project (1976-1990) that coordinated scientific seminars and joint field research projects focusing on the physical properties of ice and environmental conditions on arctic seas with an indirect, but crucial, aim to contribute to the Finnish-Soviet technology trade.

The Scientific and Technical Cooperation that went beyond the business relations was institutionally based on bilateral state-level agreements with an officially articulated motivation to strengthen the friendly co-existence of the small capitalist and the big socialist country, Finland and the Soviet Union. The Arctic project was initiated by Finnish profit oriented heavy engineering industry and in practice carried through by Finnish technical research centers together with Soviet organizations. The project enabled Finland, a country without own Arctic coastline, to gain a strong position on the Soviet Arctic offshore fields as a technology supplier and supported Soviet Arctic oil explorations that were in the beginning dependent on imported technology. The project realized because it fit well political conditions but it was not just about political rhetoric as it had tangible results in the development of Arctic Maritime technology in both countries.

Methodologically the study combines archival sources from Finnish industrial discussions and the Finnish-Soviet negotiations and compares these with the information of realized projects. By contrasting these different sources, the paper increases understanding of processes in which technology transfer is contested, compromised and – eventually in some cases– realized.

The paper argues that even in the relationship between a small and a big country, different economic, technical and political advantages provides the weaker partner significant room for maneuvers.

Cold War, Arctic Maritime technology, East-West technology transfer, scientific-technological-cooperation

Prime movers or cogs in a machine? Doctors, scientists, and engineers in forging international rehabilitation programs

Slawomir Lotysz, Institute for the History of Science, Polish Academy of Sciences

We tend to believe that international aid programs, whether for ad hoc relief or long term rehabilitation, are initiated and formulated by politicians, while scientists, engineers, doctors and relief workers only step in afterwards, to provide the aid. This is the message conveyed by the media, which usually presents, for example, a set-off program as being the result of political negotiations. In fact, the

signing of agreements is the last stage of what often begins as a bottom-up initiative, devised by a visionary local expert, who understands both the problem and how it needs to be solved. When, in early 1946, the United Nations Relief and Rehabilitation Administration (UNRRA) announced its new program of building penicillin factories in Czechoslovakia, Poland, Yugoslavia, Italy, Belarus and Ukraine, it had in fact been preceded by long negotiations that had been initiated by doctors who, as early as 1944, had understood both the significance of antibiotics and the fact that Eastern Europe's need for penicillin could not be solely dependent on supplies from relief organizations. This paper aims to explain the role of Czech scientists in shaping UNRRA's penicillin plant program, from its inception to its finalization. It will argue that the Czech experts – a microbiologist, a chemist, and an engineer – played a crucial role in the collaborative effort to overcome the obstacles that slowed the program down under the East-West tensions on the eve of the Cold War. In the broader context, this analysis will contribute to a redefinition of the roles of the technical and scientific experts from the countries aided, from being passive takers to active agents of change, and their contribution to the circulation of knowledge. The paper mainly uses primary sources from American, British, Polish, and Czech archives, and is partially comprised of the results of a larger, ongoing research project on penicillin production in Eastern Europe.

health; pharmaceuticals; Cold War; technology transfer

Cold Submarine War: US intervention to stop Finnish submarine manufacturing to the Soviet Union in the 1980s

Timo Myllyntaus, University of Turku

Finland has a series of unfortunate attempts to build up a successful production of submarines. Even before the World War I, Finland built small submarines for the Russian army but the Great War terminated the production. The interwar attempt failed as well. After the World War II, the Allies – primarily the Soviet Union – forbade the country to produce military submarines. Still at the moment, Finnish shipyards are capable to produce high tech submarines but this time the USA prevents Finland to restart its submarine production.

In the 1980s, the USSR ordered two small research submarines from a Finnish shipyard, Rauma-Repola. Because they cost 17 million euro each at the time, they seemed to be a lucrative business for the Finnish shipbuilding industry. Nevertheless, soon after these two deep-sea submarines were delivered to the Soviet Union in 1987, the USA started to pressure the Finnish government and the shipyard to discontinue the production of these exceptional submarines, which could dive to the depth of six kilometres and explore 98% of all seas in the world.

This paper examines why the USA intervened in the Finnish-Soviet trade and why it still prevents Finnish shipyards to produce research submarines. Nevertheless, it cannot prevent Russia use its two Finnish-made, 7.8 m long submarines for various purposes. By hiring one of them, the Canadian film director James Francis Cameron shot the genuine wreck for his film *Titanic*, released in December 1997. These two small – more than thirty-year old – submarines are still active and remain in limelight of world politics.

"Transfer of technology"; "Cold war"; "West-east trade"; "Soviet Union"; "Finland"; "Shipbuilding"

Technological Assistance from the USA to China in the late 1940s

Xingbo Luo, University of Chinese Academy of Sciences

The United States of America started its systematic and big scale technology transfer to China during the late period of the World War Two. The War Production Bureau (战时生产局), which was established as its counterpart, the War Production Board in the USA, played a quite positive role during the wars against the Japanese army since its establishment, and was highly regarded by the Nanking government of the Republic of China, which was in power from 1 July 1925 to 20 May 1948. Upon the request from the Nanking government, the government of USA sent some technology missions to China, such as the Nelson mission (纳尔逊使团), the Sino-US teamwork on agriculture technologies collaboration (中美农业技术合作考察团) and so on, the American experts worked with their Chinese colleagues, investigated the geographic environment, natural resources, agricultural productions, and the industry factories etc. Then they proposed advisory plans to the Nanking government. Aimed at the China reconstruction project after the World War Two, the Nanking government selected and implemented some of the plans, and with the assistance of the US government, modern technologies were transferred to China.

Based on the archives of foreign affairs, my research investigates the transfer of American technology to China and the conflicts between the advisory plans promoted by American experts and the Nanking government's wishes.

Technological Assistance; technology transfer; 1940s ; USA and China

032. 12th Annual Symposium of the Social History of Military Technology

Wishes, planning and reality. The first Peronist's Five-Years Plans and the Argentine military aeronautical industry

Carlos de la Vega, FAMAF-Universidad Nacional de Córdoba

In the middle of the XX century, the Peronist movement started in Argentina the first systematic attempt to industrialize the country. One of the planning instruments intended to be used were the so called "Planes Quinquenales" (five-year plans) and, one of the areas where more effort was put in, was the military aeronautical industry whose main epicenter was the Military Aircraft Factory (Fábrica Militar de Aviones). Even though the results obtained in the aeronautical field were very distant from the ones that were originally planned, a new sector in the economy emerged: the automotive industry. The reasons of the five-year plans' failure in the Argentine military aeronautical industry are related to both the state of affairs at that time and certain idiosyncratic features of the factory where that activity was based.

Argentina; Peronist; industry; aeronautical; planning

Italian Air Force and Space: 1914-2014

Ciro Paoletti, Commissione Italiana di Storia Militare

Although it has only seven astronauts till now, Italian space activity ranks third in the world after USA and Russia, and since the origin the Italian Air Force had a basic role in it.

In 1914 Giulio Costanzi, an artillery officer who the next year passed into the Air Corps and later into the Air Force (and who later wrote *Elementi di aerodinamica e dinamica del volo*, the first Italian book about such a topic), published an essay about the technical feasibility of a space flight, and wrote that it needed a special power. He supposed it could be probably provided by the radium, which, he said, meant a nuclear engine.

Between the two World War Gaetano Arturo Crocco, a general of the Royal Air Force, invented the first all-Italian liquid-fuelled combustion chamber and contributed to the development of the gravity assist technique invented by Michael Minovitch in 1961, now used on planetary fly-by's by space probes, by American, Russian and European space vehicles, accelerating with a reduced fuel consumption.

After World War II, Air Force general Luigi Broglio established the Italian space activity. He planned the San Marco project, which in 1964 made Italy the third Country in the world having a satellite in the space. Later Broglio organized a sea based launching station in the Indian Ocean and made the first equatorial launched pad in the world.

Due to this activity and experience, Italy was a major founding partner of the European Space Agency, but kept also its own independent Italian Space Agency – ASI – and, aside from the Ariane project, developed its own missile VEGA and cooperated with both USA and Russia too in many space activities.

Air Force, Astronautics, Italy, Space

'Armament projects: The Greek Air Force case, 1975 to 2010 Critical episodes and economic crisis'

Dimitrios Ziakkas, Department of Philosophy and History of Science National and Kapodistrian University of Athens

The history of the contracts of the Greek aviation projects (The Greek Air Force case, 1975 to 2010 Critical episodes and economic crisis case study) is tightly combined with the history of the military aviation projects of the United States, as Greek Air Force mainly follows US structure with a delay of 10-15 years. Selected critical episodes help us to identify the orientation and the level of the intended technological change.

In this approach a vertical reading of military avionics journals was followed. The research was focused on the companies', Ministry of Defense-Parliament archives, DOD site and long discussions with a team of experts.

Main concern for the Greek headquarters was the Turkish activity and the establishment of a new air defense doctrine. Doctrine was oriented in interception missions for many decades, focusing on specific types of airplanes and losing strategic advantage contrary to US experience.

The Greek government several times signed agreements with companies which technical protocols had not been approved by the Greek Air Force headquarters. This has resulted in a continuous situation where a great amount of the Gross Domestic Product (GDP) of Greece has been spent into armament projects with low performance. Presentation of Greek GDP % of military projects contrary to EU/ NATO / Turkey in relation to critical episodes and the deep economic crisis offers a critical review of the Greek case study.

A continuous point of reference in the Ministry of Defence's procurement policy was the gradual hellenisation of supplies, in such a way that the domestic defence industry became the main supplier of weapon systems to the Greek Armed Forces.

Regardless of the skills, patents and innovative reconstruction of the existing technical protocols, the overall performance was limited by the initial limitations that had been agreed during the contract phase of each military aviation project. The conclusion of this presentation is that the adaptation of electronics technology in the Greek military's aviation projects has mainly been based on initial contracts and image. It is not a reflection of actors' capabilities, or as is usually the common belief, the result of the outstanding performance of the Greek Air Force's employees.

Armament; projects; critical; episodes; adaptation

Cold War Human Factors Engineering: Bringing People into Military Systems Development

Layne Karafantis, Smithsonian National Air and Space Museum

The fields of systems engineering and human factors engineering (or ergonomics) were professionalized in the early years of the Cold War in large part due to the construction of military weapons systems.

The NORAD Combat Operations Center, designed by the MITRE Corporation, was a testbed for the layout of command and control rooms in the 1960s. MITRE conducted quality control tests with regard to human factors in this space, and their findings helped inform future command room designs. In the following years, a number of laboratories initiated research programs in efforts to better understand man-machine interactions, resulting in a vast literature on the topic. This all began due to Cold War imperatives.

MITRE Corporation reports, NASA documentation, and Air Force studies, as well as well secondary source material on human factors engineering, inform this work. Major conclusions include: (1) development of Cold War military systems catalyzed the fields of systems engineering and human factors engineering and ergonomics, (2) later civilian and commercial systems utilized the research initially done for military purposes, and (3) this connection demonstrates the impact of such technologies on larger populations.

human factors; NORAD, systems; US Air Force

The Brazilian Army's Use of Observation Balloons in the War of the Triple Alliance

Guilherme D'Andrea Frota, Marinha do Brasil

The Marquis de Caxias took the command of Brazilian operations after the disastrous battle of Curupaiti (22 Sept. 1866) in the War of the Triple Alliance, also known as the Paraguayan War (1865–1870). A major factor in the Allied defeat was inadequate reconnaissance and lack of information about the terrain over which the battle was fought. As a means to remedy this problem, Caxias turned to a novel technology that had been deployed (with mixed success) during the American Civil War, observation balloons. Initial attempts to construct a balloon in Brazil proved unsuccessful. So Caxias turned to the United States, contacting the former head of the US Balloon Corps, Prof. Thaddeus Lowe. Caxias was able to purchase two balloons along with the Lowe-invented equipment to manufacture hydrogen in the field. He also obtained the services of two balloonists, the brothers James and Ezra Allen, who had worked with Lowe in the Civil War. Balloons proved to be invaluable for Brazil. Observation balloons can be credited with being a significant factor in Brazil's later battlefield victories.

Ballon, War, Brazil, triple Alliance

L'impact des matériaux et de la fabrication des armes sur leur utilisation dans le monde grec antique

Jean-Nicolas Corvisier, Université d'Artois

Dans la Grèce antique, la pratique de la phalange, hoplitique ou macédonienne n'obéit pas seulement à un modèle psychologique, mais elle est fonction des ressources naturelles et de leur transformation par la technologie afin de créer des armes qui représentent le meilleurs compromis entre offensive et défensive, combat individuel et combat de masse. L'emploi du bronze, la nature de l'alliage et le difficile ajustement du casque et de la cuirasse au corps de son porteur par simple martelage à partir d'une feuille de métal crée des fragilités dans celui-ci, entraîne à l'usage des déformations importantes, et laisse chez son utilisateur des zones non protégées qui justifient le recours au combat en rangs serrés et l'abandon de la longue épée mycénienne au profit du javelot d'estoc. La diversité des formes de casque et de cuirasse pourrait aussi être due à des choix d'ordre technologique. L'impossibilité de parvenir à des protections véritablement articulées s'ajouta au recours à de nouvelles formes de combat pour faire évoluer l'armement vers la légèreté. Il devenait inutile de porter des protections résistantes, les hommes étant préservés du contact par la longue sarisse. Mais la phalange macédonienne exigea de résoudre le problème de la vibration dans une longue tige de bois afin d'éviter sa casse, et donc d'avoir un talon de métal et une bague métallique intermédiaire. Sa généralisation posa cependant le problème des ressources naturelles dans le monde grec extra-macédonien et de leur mise en valeur.

Armement; matériau; fabrication; Antiquité

Founding the Foundries: Networks of Technology Transfer and Circulation of Technical Experts in Antebellum American Cannon Foundries

Steven A. Walton, Michigan Technological University

The United States at the end of the Revolution was faced with difficulties in procurement of almost all military stores, not least of all cannon. Although a number of emergency foundries operated during the War with Britain, after 1783 none of those existing foundries made the conversion to peacetime production of ordnance for new federal or state governments. The young country was therefore faced with the choice of importing artillery from abroad or developing domestic manufacturing capabilities. Although the story of small arms production at Springfield and Harper's Ferry armouries is well known, less clear is the pattern of heavy ordnance production between 1790 and 1860. This paper seeks to examine that production in terms of the networks—both discernable at the time as well as assumed by historians—of skilled artisans and political connections that led to some notably successful foundries, as well as some failures and other abortive attempts. Case studies in the paper will include the apocryphal cannon foundry designs of Mark Isebard Brunel which highlight some problems in the historiography, numerous state and Federal negotiations with domestic producers that led to naught, the federal enticing of Henry Foxall to Philadelphia and then the District of Columbia, the failed foundry of Peter Townsend and the successful West Point Foundry (both in New York State), and then the network of both Army and Navy technical experts and inspectors who negotiated uniformity between the eventual four foundries that the federal government relied upon (all the while remaining sensitive to the propriety demands of those privately-owned foundries). Finally, a brief contextualization of these developments in the repeated presidential calls for a national ordnance foundry and debates over domestic manufactures places cannon foundries in a parallel light as the production of other military technologies.

cannon; iron and brass foundries; technology transfer; expertise

033. Visions of Urban Mobility in the Global Age from the 1890s to the 1970s

Visions of suburbia before the automobile – Kurd Laßwitz's science fiction novel "Two Planets" (1897)

Eike-Christian Heine, TU Braunschweig / Gerda-Henkel-Stiftung

In his science fiction novel "Two Planets" from 1897, Kurd Laßwitz (1848-1910) imagines a technologically, culturally and morally advanced Martian civilisation. The planet is covered with a regular grid of moving walkways. These can be travelled by foot or vehicle, and the closer one gets to the centre of the walkway, the higher the speed becomes. In this scenario, cities have ceased to exist and the planet has become one vast suburbia, where one-family houses that are surrounded by lush gardens are found near the walkways and form the typical habitat of the Martian. While the walkways are used for commuting and provide access to the whole globe, the land between the walkways and the close-by houses is for the biggest part covered with a tamed and peaceful nature. Laßwitz made his utopia plausible by constructing it around moving walkways that had caused great public interest at the 1893 world exposition in Chicago. He, and other contemporary authors of Fantastique-literature, provided compelling middle-class concepts of living and working. These were partially realised in architectural trends such as the Garden City Movement after 1898. But the "Cropgrass frontier" (Kenneth Jackson) was only truly conquered, when the car provided the mobility necessary for the visions of suburbia.

Literary Visions of Technology; Cultural History of the Suburb; Urban History

Stuttgart and the Automobile. Tailoring an European City to an imaginary Traffic of the Future

Reinhold Bauer, University of Stuttgart

Since the interwar period the perception of urban space in Europe underwent a profound change: Streets and city squares were increasingly interpreted as spaces of technification or, to put it in another way, as containers for the evolving technical system of automobile transport. The central idea was that urban space should, above all, get tailored to the absorption or rather mastering of motorized traffic. The changing concept of urban space was deeply intertwined with changing visions of urbanity, which itself were strongly influenced by fordistic rationalization concepts. It should be emphasized that this development hardly reflected current traffic problems of those time but in fact was about shaping cities to an imaginary traffic of the future.

On the example of Stuttgart, a city in southwest Germany and an important location of automobile production, the paper will be discussing the process of initially discursive and then – after world war II – de facto construction of a car-friendly city. It will focus in particular on the linkage between the explicitly local strategies of reasoning on the one and the effective implementation of global visions of urban mobility on the other hand. By doing so the paper intends to contribute to a transnational history of traffic infrastructure for motorized private transport in the 20th century.

car-friendly city, private transport, Stuttgart, 20th century

034. Environmental and Energy Issues: Global and Regional, Long-Term and Short-Term

Dam's impact, international politics and colonial awareness around Cahora Bassa, Mozambique

Ana Paula Silva, NOVA University of Lisbon

The electrification of Portuguese colonies was boosted after World War II and inscribed in the policy of economic development in Africa, which was acknowledged to be important to the economic recovery of Europe, as well as to meet the aspirations of indigenous people fighting for liberation. Thus, developing plans (the French ones in 1946, the Belgian Congo in 1948, the Italian Somalia in 1954, and the British ones in several dates) were conceived and adopted. In Portugal, the first National Development Plan, including the colonies and their irrespective electrification, was conceived in 1952 and implemented between 1953 and 1958, 'turning [the dictatorial government] towards a modernising and technocratic discourse on Portuguese African development that would deepen in the 1950s and 1960s' (Castelo, 2014). Therefore, a considerable number of dams were built in Africa by the Portuguese, recruiting well trained national engineers, who, nevertheless, until the conception of Cahora Bassa dam in Mozambique (1956-1965), didn't plan any 'ecological impact studies'. Why did that change then? It is the question addressed in this paper. As Castelo (2014) noticed, development conceptions were turning 'towards the «human side» of development'. But what were the true reasons driving the Portuguese to that turn and justifying 'ecological impact studies of Cahora Bassa dam'? That initiative was indeed anticipating for about 20 years, policies approved later in a very different context of democracy, decolonization and aid. United Nations resolutions number 1314, 1514 and 2107 may lead us to an answer (Cueto Rodríguez, 2015).

"Dam's impact", "international politics", "Portuguese colonialism", "Cahora Bassa", "Mozambique"

Earth's Environment, Climate Change and its Doubters

Anthony N. Stranges, Texas A&M University

Climate scientists have shown beyond doubt that Earth's atmosphere, terrain, and oceans are warming. Their numerical models have simulated the consequences of climate-related variables (temperature, pressure, concentration) on the atmosphere. Scientific evidence obtained from surface air temperature measurements at thousands of land-based meteorological stations and sea surface measurements from ships, moored buoys, and since 1978 from satellites with remote sensing instruments; from weather balloons that provided vertical profiles of temperature, humidity, and winds; and instruments that measured subsurface ocean temperature, salinity, and currents, continued to accumulate, and by the early 2000s, active climate scientists nearly unanimously accepted the reality of Earth's warming. They have concluded that the combustion of fossil fuels (coal, petroleum, natural gas) has produced and continues to produce the warming. Fossil fuels have for centuries provided most societies, rich or poor, developed or emerging, with their energy. Despite the overwhelming evidence that humans mainly have caused Earth's warming, critics have shouted that the warming is a hoax, it is cyclical and the result of natural causes; we cannot change our energy source nor survive without energy from fossil fuels. Most of the critics are not climate scientists. They come mainly from the political world and from the coal and petroleum industries and have an economic interest in denying the scientific evidence. They aim to confuse the public and cast doubt on the research of active climate scientists. Climate politics unfortunately has replaced climate science. This paper examines the doubters' arguments, showing that their claims lack scientific legitimacy.

Impact of hydroelectric plants on the development and the sustainability in Romania

Mihai Nicolae catalin, Soc. FDEE Electrica Distributie Transilvania Sud Sa
Catalin MIHAI, Soc. FDEE Electrica Distributie Transilvania Sud Sa
Elena HELEREA, Transilvania University of Brasov

Because of Romania's favorable geographical location for hydro-potential, the development of hydroelectric plants began at the end of 1890. It continued in the inter-war period and into communist era.

Romania's first hydropower plants for power production were designed and built in 1888-1900, several years after the appearance of the first hydroelectric plants in the USA, Italy, Switzerland, and France. In this period, 13 hydroelectric plants with the power of 70 - 1000 kW each were operating in Carpato-Ponto-Danubian Space.

After the great unification in 1918, the hydropower potential of Romania was evaluated and became an important element in the energy strategy of the country. Energy projects of big hydroelectric plants continued to be developed in the communist period to cover the need of energy for industrialization, but after 1990, the rate of installation of new hydroelectric plants became low because of high investments price.

Only after 2000, the hydroelectric potential gained a new important position, sustained by the requirements to combat the effect of climatic changes and the instability of hydrological regime and to implement the concept of smart grids.

The paper analyzes the new trends included in the National Strategy for Sustainable Development of Romania and their socio-economic impact. The actual tariff systems for power energy and consequences of choices of a certain tariff on consumer costs are also analyzed.

hydropower, Energy, socio-economic impact

035. Epidemics and Technologies 1, Technospaces of Epidemics

The technology of non-infectious epidemics

Fritz Dross, Institute for the History of Medicine, Friedrich-Alexander University Erlangen-Nürnberg

Considering epidemics as technology very much relies on concepts of infection. Historical research on pre-modern epidemics thus methodologically is endangered by assuming modern concepts of certain infectious agents when studying pre-bacteriological responses to copious outbreaks of disease. On the other hand, the discourse of risk and danger as well as practices of separation and isolation and intensified governmental actions have already been common in late medieval and early modern Europe facing leprosy and plague for instance. My paper will present a case study on the imperial city of Nuremberg in southern Germany in 15th and 16th centuries focusing governmental actions and private and collective behaviour of the affected and the healthy.

While Mary Douglas following Emile Durkheim tackled the problem of the sacred contagion by separating spiritual purity from physical cleanliness, my attempt aims at historically understanding the unquestioned coexistence of spiritual, religious, and medical conceptions of "infection" in everyday practices encountering the impure and living a life at risk. In 15th and 16th centuries Nuremberg plague happened every ten to fifteen years and hundreds and thousands of lepers had

been publicly cared for in the Holy Week – epidemics had been an everyday experience. Framing epidemics as (social) technologies thus allows for historicizing and de-medicalizing our understanding of epidemics as triggering historically comparable behavioural patterns independently of their modernist medical conceptualization of being infectious or not.

"pre-modern epidemics"; "leprosy"; "plague"; "urban history"; "Nuremberg"

From Temporary Measures to Permanent Infrastructures: Controlling Cholera in Madras and Quebec, 1818-1854

Michael Zeheter, University of Trier

Epidemic cholera was perceived as a serious threat by governments in Europe, but nowhere was the disease observed with more dread and trepidation than in European colonies like Lower Canada and India. Conquered by the British in the latter half of the nineteenth century, the colonial governments perceived their own position as fragile and every disruption of public life – such as cholera – could potentially lead to their downfall. When the disease arrived for the first time in Madras in 1818 and in Quebec in 1832, both colonial governments felt compelled to react to the threat. They tried to ensure by establishing temporary institutions of medical care, with little effect.

Influenced by the English sanitary movement in both cities there was a shift from reactive temporary measures against epidemic disease to a preventive infrastructure in the 1840s. While Quebec embraced the idea of a sanitary city ensured by an integrated infrastructure of water supply and drainage and almost bankrupting the city in the process, the colonial government in Madras was fighting a protracted battle with its own engineers about the best way to drain parts of the city. The discussions about the implementation of a sanitary infrastructure in both cities not only reveal diverging concepts of the scope of the colonial state and paths of colonial state formation. They also highlight the role of technology and experts in those processes.

Quebec City; Madras; Colonialism; Urban Environment; Sanitation

Consumer society's epidemics: Pharmaceutical technologies, epidemiological knowledge and the reframing of rising drug consumption

Nils Kessel, Université Paris Est Marne-la-Vallée

Anne Kveim Lie, University of Oslo

Today as well as fifty years ago, whoever looks at political, medical and media discourses on the use of medicines will be confronted with the frequent use of bacteriological and epidemiological terms used for describing the social phenomenon of rising (legal) drug consumption: an “epidemic outbreak” “affecting” (sometimes even “infecting”) broader populations, threatening societal “bodies”. “Data” of “types” are needed for clarifying the dimension of the phenomena.

Yet, what is at stake is neither a bacteria nor a virus but different modes of use of pharmaceutical technologies. From a history of technology perspective, medicines can be considered as pharmaceutical technologies. As such their use is inscribed in discourses on benefits and risks of technological change. Some see widespread use of pharmaceuticals as a threat for public health, as a risk itself.

This paper reinterprets the relationship of epidemiology and technology beyond the metaphor paradigm: By translating the use of technologies into a medical problem that can be researched, analyzed, and – ultimately – solved through epidemiological methods, physicians have both contributed to implementing quantification as a universal tool for the resolution of primarily social

problems but also extended their own field of expertise. As quantitative epidemiological knowledge about the use and abuse of drugs is almost useless as long as it cannot be linked either to actual morbidity data or other – lower, high or equal consumption rates in other countries, comparison on an international level became vital for knowledge production. The paper's arguments are based on the historical study of market research data, medical and social science literature. Focusing on the WHO level, Norway and West Germany, it retraces how technology use became reframed as an epidemiological object.

Consumption; Medicine; Drugs; Quantification; Pharmaceutical markets

A sanitary technology from crisis to routine: Antityphoid inoculation in French Army, 1918-1930s

Rasmussen Anne, University of Strasbourg

Since the 19th century, typhoid fever caused numerous epidemics in military populations in wartime and in peacetime. Prophylactic control of these epidemics was a major challenge for military health services : it concerned preservation of operational troops and sanitary interactions between civil and military populations. European military health services (in Britain, Germany, France) chose a sanitary technology - antityphoid inoculation – among several prophylactic strategies. They made mass experiments in the conflicts of the beginnings of the century (Boer war, colonial conflicts, World War I). In France, antityphoid inoculation, which was only compulsory for soldiers, was at the core of acute controversies during World War I, related to vaccination technology. What was at stake was ways of producing, circulating, prescribing, administering vaccine and development of bacteriological, clinical and statistical norms. Efficacy and safety of inoculation were very controversial because of important adverse events linked to inoculation, graduated from side effects to fatal accidents.

This paper will explore what became antityphoid inoculation in French Army after World War I. Based on sanitary archives of Historical Defense Archives, it will focus on the routinisation of a sanitary technology conceived in wartime. Ways of qualifying and regulating adverse effects and accidents of inoculation will be studied, as a means of testing mass medicine.

Epidemics Public Health Inoculation Sanitary technology World War I

036. The Workflow of Oil: Upstream, Midstream, Downstream Technologies in 19th and 20th Century

The Petroleum Pioneers in the Age of Illumination

Evangelidis Vasileios, University of Leiden

The presentation focuses on the historical development of oil refining technologies. The aim is to analyse the most relevant early processing methods, from the refining of coal oil to the introduction of gasoline and lubricating oils, the development of the methods of atmospheric distillation, the reforming, and the catalytic (or thermal) cracking.

The role of the pioneers was important in that story: James Young, in the early 1850s, produced paraffin oil from coal in Scotland. Abraham Pineo Gesner in Canada refined kerosene from coal and Trinidad Island asphalt. In 1852, Boston, the Atwood brothers made a lubricant from coal tar, while Ignacy Łukasiewicz in Poland and Benjamin Silliman Jr. in USA boosted the quality of the processes to produce kerosene.

In 1866, the invention of more efficient cylinder refining-stills improved the process of distillation. By 1875, the refiners implemented a new method for the utilization of the residuum of the crude oil, left after the manufacture of illuminating oil. In addition, in the shale works of Scotland, they started to refine paraffin wax and lubricants. In 1876, Herman Frasch received a patent for the purification of paraffin wax. In late nineteenth century, gasoline was considered just a waste product of kerosene production, so the refineries tried constantly to get rid of that, because it was very volatile and easy to fire. They used to burn it for fuel in distilling for oil, or let it run into creeks and rivers. In 1882, the Nobel brothers Ludvig and Robert utilised in southwest Russia the methods proposed by Dmitri Mendeleev to purify oil with thorough distillation. At the same time, Herman Frasch worked upon desulfurizing oil and Vladimir Shukhov developed the method of thermal cracking of crude oil, which were among the most brilliant and advanced processes that opened the gate to the twentieth century refining industry.

petroleum, refining, gasoline, distillation, cracking

The Oil: Godsend or Curse?

Helerea Elena, Transilvania University of Brasov

Liviu Alexandru SOFONEA, Transilvania university of Brasov

Marian RIZEA, University of Oil and Gas, Ploiești

The oil is superior to all the other combustibles, the raw material which is wanted and courted by top sectors of the modern industries, is all over the human life, it is an important factor in people development, „the black gold” which roughly dominates nowadays the economy and the civilisation, giving birth to a real „oil era”. The oil, with its controversial identity or origin (it is still in researchers’ debate on its organic or anorganic origin) is a two-side character: a friendly one and menacing one. Angel or monster, „a godsend or curse”, the oil has an ancient history whose origins are lost on the way. The oil is cause and effect at the same time; it decides the end of wars, which on their turn decide the future of the oil; where those who have the power oppress the small ones, and afterwards the small ones will revenge on the powerful people. It becomes more and more obvious the fight of the great powers over the control and the management of the planetary energy. If the beginning of the oil supply’s exploitation, set at the middle of the 19th century was induced more likely by some people’s desire to become rich, nowadays, the access and especially the management of energetic resources became an acute need for developed, medium and small countries.

Many papers were written about oil and gas and people will probably continue to write in the future. Since 1857, when Romania was registered as the first producing country with an oil production of 275 tones (a fact mentioned in „The Science of Petroleum”) and until now, Romania had a great contribution in scientific and technical development of the oil and gas field in the world and it founded the bases for building the Romanian industrial society.

Having the support of multiple sources of information – books, papers, editions of The monitor of Romanian Oil – this paper presents the main turning points in the evolution of technology and oil industry, with the purpose to understand the roleplay, the place and the technical economical and scientific contribution of the Romanian researchers to evolve and develop the human society.

History of oil; oil supply exploitation; impact of oil industry; industrial society

Energy Innovator without Energy: Refining in Korea from Nation-Building to Innovation

The History of Petroleum Development in the Permian Basin

Joseph R. Dancy, Oil and Gas, Natural Resources, and Energy Center, The University of Oklahoma College of Law

The Permian Basin is the largest petroleum-producing basin in the United States. Located in West Texas and in the southeastern area of New Mexico, this legendary geologic region caused fortunes to be made and lost, and corporate empires to rise and fall. The prolific hydrocarbon bounty of the area results from one of the known thickest deposits of Permian-aged rocks in the world, which were formed from downwarped geologic structures overlain by the ancient and biologic-rich Permian sea. Although the Drake Well in Titusville, Pennsylvania was the first successful oil well in the country, the discovery of the Permian Basin's basins and fields arguably cemented the United States's position as an energy producer in the early age of oil. The drilling of the first test well, the Santa Rita, heralded an age of hydrocarbon bounty that continues today. Indeed, George Mitchell's prodigious combination of horizontal drilling and hydraulic fracturing has further incentivized explorationists to conduct new drills, in addition to recompleting existing wells. This presentation examines the historical origins of oil and gas development in the Permian Basin, focusing on those technologies (both geoscientific and engineering) that served as catalysts for development. It will also examine certain key individuals, institutions, and companies that served as proponents and visionaries in the area's development. This examination will be done in conjunction, and recognition, of major economic events in U.S. history, such as the Great Depression and the turbulent period of the 1970s and early 1980s, which influenced said development.

petroleum; Permian Basin; oil; technology; fracturing

037. Unconventional History: Sixty Years of Science and Technology in Hydraulic Fracturing

Scientific communication in the new technological frontier of unconventional plays

Daniel Minisini, shell
Manuel Fantin, chevron
Patricio Desjardins, shell
Iván Lanusse-Noguera, YPF
Gabriela Gonzalez, consultant
Denis Marchal, pampa energia
Laura Gomez-Rivarola, TOTAL
Fabian Dominguez, YPF
Dolores Vallejo, chevron
Diego Kietzmann, Univ Buenos Aires
Toni Simo, Exxon
Gauchito Gil, consultant
Federico Gonzalez Tommassini, YPF

More than ten years have passed since the energy revolution driven by the production of the so called Unconventional Plays. In this short time span, Industry has moved from a general secretive and confidential treatment of data to a more relaxed method of data sharing that has allowed cooperation in an environment of competition. We call this form of scientific communication "co-opetition". Our co-opetition arose from the Vaca Muerta Unconventional Play (Argentina), one the best

producers in the world and it represents an important shift in the data sharing of technical information in the Oil & Gas Industry. The small profit margins typical of the unconventional business dictated the need to rapidly characterize the subsurface rocks in order to be predictive. Hence, the nature of the business in this new technological frontier of unconventional plays forced the scientific community to create a new model for communication and data sharing. Our co-opetition optimizes the expensive data collected by each company by sharing it and putting it in a broader context that is built and vetted by all the other players, in a “check and balance” fashion. Once the data and the agreed context are in place, then each player differentiates by their own interpretations.

communication; unconventional; hydrocarbon; geology; coopetition

The unconventional thinker and the hippogriff: the making of new technological trajectories in oil production during the 20th century

Francesco Gerali, University of Oklahoma

The modern oil society made the first moves on late 1850s, when the level of knowledge and technological education of humankind on petroleum allowed the inception of the mass production of oil. Since the beginning of the business it was felt necessary to maximize the performance of the fields. Relying only on the limited geological evidence available, technologists soon conceived methods to enhance the productivity of the wells through intrusive and/or destructive technologies. Oil scientists improved that trend during the 20th century by experimenting and achieving new kind of methods to approach, stimulate and maximize the yield of the reservoirs.

The development of complex and innovative technologies to produce conventional oil from ordinary wells may be acknowledged the overture of the today breakthrough occurring in oil & gas production. This presentation aims to frame and analyze both the overture and the following merging of knowledge and artifacts that found momentum when it was successfully adapted to exploit shale reservoirs: the so called unconventional deposits of oil & gas.

The literature review of not-technical/industry publications from the past thirty years highlights how the unconventional is mostly discussed from political and/or environmental perspectives. There is a substantial lack of historical analysis on the, complex and heterogeneous, set of technologies that revolutionized the geography of the oil fields, and opened the door to new and not easy to predict energy scenarios. The author intends to outline an historical review to explain the emergence of the idea of unconventional resources, to describe the context in which it developed, and to recognize the factors that lead exploration workers to develop an unconventional mindset.

Oil; Unconventional; Hydraulic

038. Problems in Introducing New Energy Technology

The Electrical Banal: The Technologization of Anderson, South Carolina, “The Electric City”

D. Travers Scott, Clemson University

At the turn of the twentieth century, “The Electric City,” Anderson, South Carolina, was a regional, national, and global leader in new technologies of electrification. Contrary to common narratives of technological history, residents typically did not have utopian or dystopian reactions. In this paper, I show how electricity was rationally integrated into disparate dimensions of individual and social life.

In contrast to theorizations of an “electrical sublime,” we see what I refer to as an “electrical banal.” Drawing on primary archival research into local media accounts and regional publications, I describe the media discourses on electricity from Anderson and surrounding areas. In these, one sees, rather than a disruptive technological impact, many ways in which the new flows of electricity were accepted into the lives, economies, and bodies of users in a most quotidian fashion. Augmenting this with direct observation of Anderson today, I explore a counter-history of electrification. What we see in Anderson is not limited to atomistic individuals reacting to technological things—electricity, illumination, and telephony. Instead, we see a complex process of integrating technological phenomena into multiple facets of daily lives. Andersonians were becoming consumers of electricity, but also users of it, as they applied it to different tasks, including identity work and social projects. Electricity did not make them into modern citizens of the New South; they used it in their own attempts to become such. In ongoing processes, Anderson, SC, becomes and re-becomes The Electric City. The residents become electrical subjects and often use the new technologies in ways that reinforce other social phenomena. Although electricity is new, a perspective of its integration—rather than reactions to it—help show how it was entangled with ongoing becomings of race, gender, and power hierarchies.

electricity, utopia, dystopia, counterhistory, Southern US

Solar energy techniques and their intermittent duration (XIX-XX centuries)

Antoni Roca-Rosell, Universitat Politècnica de Catalunya
Nelson Arellano, Universidad Arturo Prat

Solar energy played a very important role in the mining industry in XIX century at Atacama Desert. Nevertheless, the solar techniques used mainly for desalination of water were discarded in earlier XX century, and subsequently completely forgotten. In the 1950s their memory was recovered in USA, and solar technology has been used again in Atacama Desert at the industrial scale. At this time, a scientific and engineering world-wide network has been built.

The conception of evolution of technology has been discussed by George Basalla as a result of the confrontation of continuity and novelty through selection processes, affected by economic, social, and environmental dimensions, techniques, and policies. Gille and Hughes stated that the management of artefacts generates socio-technical systems; Unruh said that a technological momentum tends to lock-in the technical alternatives to generate competition through a lock-in of a techno-institutional complex. Finally, the 7th thesis of David Edgerton states that in the history of technology the preferred option is not always the most economical alternative. Moreover, it is not always the healthiest for human and non-human beings.

In this paper, we would attempt to understand some aspects of the social values and cultural factors involved in the early history of solar energy industry in the Atacama Desert. The work has been based on Chilean, USA, and European archives. The research encourages, in Basalla's words, the development of a narrative on viable alternatives to winning technologies.

"Solar energy technologies"; "evolution of technology"; "intermittent duration of technologies"; "innovation"

039. Science, Innovations and Patents

Scientification between the global and the local: The historical development of labour sciences and the Ruhr mining industry since 1945

Martha Poplawski, Deutsches Bergbau-Museum Bochum

My paper discusses the classification of local labour sciences studies, carried out in the Ruhr mining industry, in the genealogy and the established discourse of scientification of management. I assume that the established scientification discourse was a factor of influence in configuration the local labour science studies.

The connection of science and industry presented since 1945 an important part of operational practices in the German coal industry. Due to the contextual social, political and economic continuities and changes the managements of the mining companies saw themselves faced to new major challenges. These included the problem of labour shortage, the challenge of a successful integration of the newly hired miners and the continuously prevailing fluctuation problem. Under these circumstances, the requirement for a new form of management came on. For this, the medium and high management fell back to analysis of work sciences of various institutions. Through this initiative several labour science institutes were tasked with sociological studies carried out in the mines of the coal industry. At the same time the mining companies took advantage of the scientific exchange with various institutions and "experts" to diagnose the contemporary situation and to work out recommendations for future operational policy practice.

The main issue of this examination is: Which application of the ergonomics studies can be found in the practice of management? The discussion will include aspects of the organization and conduct of the studies, actions and reactions of the involved actors as well as the actually implemented measures and their impact. At the same time, it will be asked how the here presented analysis can be classified in the genealogy of the scientification of management. Finally, it must be clarified what kind of influence the established scientification discourse had on the local labour sciences.

Labour history; History of science; Scientification; Mining industry

Patenting and Licensing Strategies of an Independent Engineer: The Case of Heinrich Aumund (1873-1959)

Wolfgang König, Technische Universität Berlin

Heinrich Aumund was one of the first professors for conveyor Technology, teaching between 1909 and 1935 at the institutes of technology ('Technische Hochschulen') in Danzig/Gdansk and Berlin. As a member of the Prussian ministry of education, Aumund was responsible for reforming the 'Technische Hochschulen' between 1920 and 1926. Furthermore, he established a successful private engineering office for the planning of materials handling in mining and the iron industry in 1922. From 1892 to his death in 1959, he took more than 200 patents and founded a company in order to commercialize them. Most of his patents were filed in Germany, Great Britain and France but also in other European countries like the Soviet Union and overseas countries such as the United States and Chile. My paper will analyze Aumund's patenting and licensing strategies and their success and failure. Was he successful in winning licensees and earning money? Where there any conflicts between Aumund and the licensees, and if so, what were those about? Did his patents contribute to disseminate German conveyor technology in other countries?

The paper is based on Aumund's 200 patents. The contexts were researched when preparing a biography of Heinrich Aumund.

040. Politics in Constructing Infrastructure

Technology and Colonialism: Did the British Overrate their Technological Might in the Groundnut Scheme in Tanganyika, 1945-1961?

Frank Edward, Darmstadt University of Technology

Colonialism has been perceived by some historians as an important episode that ushered the Global South into the modernity. Against this statement has been discussion of vast projects that were undertaken by the colonising societies on their colonial empires. Michael Adas (1989, 2005) discussed infrastructure projects as colonising tools; in that they did not just bring modernity rather they facilitated colonisation. In another dimension, Capser Andersen (2011) has explained how civil engineers sought vigorously to 'civilise' Africa through engineering projects they lobbied for at their metropolitan and colonial capitals. The dimension which is narrowly discussed in balancing this discussion is the one in which massive financial and technological resources were invested and failed in the hands of the marshals of modernisation. This paper seeks to contribute in this latter dimension by discussing the groundnut scheme of the British in colonial Tanganyika soon after the WWII. Contrary to the existing literature on the project that has narrowly examined the technological aspects of the colossal project at the expense of huge financial resources that were invested (cf. Iliffe 1971), this paper will highlight more on technological issues. It will be argued that technological naivety of the British government in London played a significant role in massive failure of the groundnut scheme that was implemented in three districts of Tanganyika. To do this successively, this paper will employ archival and secondary sources obtained from the national archives of Tanzania and Britain as well as in several libraries.

Technology, colonialism, groundnut scheme, Tanganyika

Representation, Negotiation, and Tinkering: Stories of Electrification from Colonial Dar es Salaam

Mikael Hård, Darmstadt University of Technology

The history of technology in colonial settings still tends to reproduce the story line set up by Daniel Headrick more than thirty years ago: technologies were primarily _Tools of Empire_, introduced by imperial powers to control and exploit their subjects. The proposed paper presents a couple of case studies that challenge this traditional narrative of domination and subjugation. Based on sources from the National Archives of Tanzania and taken from the era of German and British rule in Tanganyika, the stories indicate that colonialists introduced new technologies for reasons that we recognize from North America and Europe; that the adoption of technology was a matter of constant bargaining between authorities, providers, and customers; and that users quickly learned how to "tamper" the system to their own advantage. Exemplifying the implementation and application of electricity in Dar es Salaam in the first half of the twentieth century, the chosen vignettes highlight processes of representation, negotiation, and tinkering. They contribute to an understanding of colonial technologies that does not, in principle, differ from how historians of European and North-American technology nowadays interpret their findings. We need treat technologies in the Global South with the same methods and from the same perspective as we do when investigating technologies in the Global North. Bringing up Jenny Robinson's concept "ordinary cities," the paper suggests that we have to analyze technological

developments in Africa as ordinary processes that indeed appear much more familiar to traditional historians of technology than they might have expected.

Electrification; Tanzania; Dar es Salaam; Historiography

041. Taking New Directions

'Engineers and the 'cultural crisis'-debate in the nineteen fifties and sixties in the Netherlands and elsewhere'

Dirk van Lente, Erasmus University Rotterdam

The two decades following upon World War II were a golden age for Dutch engineers. Harbour facilities, bridges and railroads that had been destroyed during the war had to be rebuilt, a new network of highways was created, a large land reclamation project was carried out and technically advanced flood protection was built in the most vulnerable part of the country. Engineers achieved prestigious positions in multinational firms such as Philips and DSM, as well as in government agencies. The creation of a well regulated, competitive and prosperous society was in large part in their hands. Opinion polls showed that the Dutch held their engineers in high esteem and that they were proud of their technical achievements.

Yet at the same time, the cultural climate was deeply pessimistic. Many intellectuals spoke of a cultural crisis, a decline of morals, especially among the young. They held technological advance at least partly responsible for a descent into materialism and moral indifference. The Netherlands was not unique in this respect. In a famous lecture, the English scientist and novelist C.P. Snow argued that literary intellectuals fostered an unwarranted pessimism about modern science and technology among the public. Because of their prominent positions in politics, they were also often hindering technological progress, which was the only way to solve the world's problems. He pleaded for more optimism, which in his view was typical of the attitude of engineers and scientists.

In the Netherlands, however, many scientists and engineers were on the side of the pessimists, even while the technologies they created were reshaping the country at breakneck speed. This paper analyses this discrepancy, using mainly periodicals of scientists' and engineers' professional societies, and compares their debates with those of their colleagues abroad, about which some studies are available.

engineers, culture, postwar

Electronic Music in the 1920s: National or International Origins?

Hans-Joachim Braun, Helmut-Schmidt-University

For some decades, electronic music has played a significant role in art music but even more so in popular music. Its origins are linked with the rise of electro acoustics in the early 20th Century. Looking at the literature on the origins of electronic music there are several studies on individual inventors such as Thaddeus Cahill and his Telharmonium, Leon Theremin and his Thereminvox, or Oscar Vierling and his Electrochord, and there also several surveys of early electronic music. But the literature does not make clear if in the 1920s, the most decisive period in the development of early electronic music, individual inventors in their national contexts or communication and exchange of know how in an international context were dominant. On the basis of the literature but also of unpublished sources I will argue that electro-acoustic research in Russia in the pre-Revolutionary period with Leon Theremin and his invention of the Thereminvox in 1920 was the most relevant.

Similar to the legendary 17th Century inventors, adventurers and alchemists such as Johann Joachim Becher, who went from court to court exhibiting their latest inventions and evoking awe and wonder, Theremin familiarized musical and scientific circles in different parts of Europe and North America with his early electronic instrument. He was also the inventor of the “bug”, the famous covert listening device, of the first motion detector, and of the “Buran” which detected sound vibrations in glass windows by infrared beams. Theremin started trend to advance an international movement which tried to develop and explain the wonders of early electronic music.

electro acoustics, electronic music, Leon Theremin

Technology in middle European mining law texts from 12th to 14th century

Lena Asrih, Deutsches Bergbau-Museum Bochum, Forschungsbereich Bergbaugeschichte

Medieval mining technology in Europe is mostly known by archaeological findings and pictures. Written sources on mining are known from 10th century on, but only few until the mineral royalty (German “Bergregal”) had been implemented since the 12th century. Henceforward, an increasing number of documents like contracts, concessions and mining regulations of different types – especially regarding silver ore mining – is preserved. The mining law texts from 12th to 14th century are an important and simultaneously underrepresented source for several aspects of mining history. Since the mining sector is generally referred to as one of the most technologized spheres of the middle ages, it seems likely to analyse the mining law texts with regard to their informative value of technological developments. New techniques – e.g. the use of water power for smelting or the use of the compass for measurements – are named or even described in those texts as well as traditional tools and techniques – e.g. hammers and gads or picks and fire setting. Taking an additional look at the results of mining archaeology, the proximity of the mining law texts to past mining practice is obvious. By looking at the regulations it is for example possible to constitute potential risks of applied technology or to learn about the respective aspired benefit. Medieval mining law is lacking modern research, but some new text editions and works on specific mining law texts exist. The older works are mostly written by 19th century law historians. Those writings, the later works of mining historians and the mining law texts itself build – next to my own work on the mining law of Freiberg (German “Freiberger Bergrecht”) – the basis of this talk.

"medieval mining history"; "medieval mining law"; "mining archaeology"

042. Visions and Realities of Automation in the 20th century

R.U.R. and beyond. The automation discourse in the 1920s and 1930s

Frank Dittmann, Deutsches Museum

In 1920 the Czech writer Karel Čapek introduced the term robot with his play R.U.R. - Rossum's Universal Robots. Soon after the text was translated into various languages and many theaters worldwide staged the play. Although Čapek used the word robot for a human-like, biological creature, the public understanding moved soon to a machine man. This was much more compatible to the mechanization discourse in the 1920s. The idea of robots in the sense of machines, able to act in the real (industrial) world, which has a long tradition in the European intellectual history, together with the discussion on assembly line production, scientific management and Fordism shaped the vision of automation. With the industrial robot an important element, the flexible mechanical

“hand”, came into existence in the 1960s. Another key element, the “brain”, was found in the computer which was considered as technical basis for Artificial Intelligence since 1956.

The paper will use the media hype of artificial creatures in novels, plays and films around 1920 as a starting point for discussing the development of the automated production concept. This idea was influenced by many elements of technology, economy, management theory as well as art, philosophy or even labour movement. Showing several examples from different fields, the complex process of shaping the perception of automation will be illustrated.

History, Robotics, Artificial Intelligence

Challenges of computerization: the example of the printing unions

Karsten Uhl, Helmut Schmidt University Hamburg

This paper deals with technological, social, and cultural transformations in the printing industry during the 1970s and 1980s. It is crucial to focus on this context for investigating the trade union crisis of this period. The printing union gives a good example, because of its strong position rested on a strong force of qualified workers. The main focus will be on the invention of computer technology during the 1970s and 1980s; the establishment of Desktop Publishing since 1985 then marks the preliminary completion of computerization in printing industry.

Automation – in printing industry foremost in the special form of computerization – challenged the unions in three ways: Firstly, on the discursive level, labour’s traditional believe in technological progress in general became fragile. Secondly, on the level of political action, strikes being the unions’ most important power resource became vulnerable: computerization enabled production outside of the factory and even without skilled workers. Thirdly, on the level of workers’ self-perception, the image of printers belonging to an aristocracy of labour became obsolete in context of computerization.

The paper examines historical actors on three dimensions: local, national, and international. On the local level, the printing union’s local associations and work councils will be investigated. On the national level the German printing union and the German Trade Union Federation will be analysed, and on the international level, the International Graphical Federation and the European Trade Union Congress will be investigated. Further, it will be examined to which extent the union crisis was first caused by technological change and then pushed the trade union movement’s Europeanization.

computerization; trade unions; printing industry; Europeanization; labour history

From Mechanization to a Networked Control System. Automation in German Coal Mining in the 1970s

Nikolai Ingenerf, Deutsches Bergbau-Museum Bochum

In my presentation I discuss the perspectives and realisation of automation in German coal mines. I assume that the special requirements of deep underground mining led to a specific form of automation beyond the utopian view of “electronic brains” and robotic workers.

Automation was one of the leading visions of industrial future until the 1970s. It promised an increase of productivity and a reduction of labour costs as well as an improvement of safety at work. In public magazines the term of a “Menschenleere Fabrik” (deserted shop floor) controlled by robots became quite popular. Of course these visions overestimated the possibilities considering the low abilities of computer-aided control at that time. Nevertheless automation was one of the main topics in research and development of European mining. In 1966 the Bevercotes Colliery in Great Britain was presented

to the public as “the push-button mine” and became an often referred example for a fully automated mine. However, this mine never reached the anticipated productivity and at the beginning of the 1970s the topic of automation concerning this mine vanished from the mining literature.

During the coal crisis from the end of the 1950s to the end of the 1960s and its impact on German coal mining the expectations of automation rapidly became quite moderate. In the course of this development the ideal of a fully automated mine was rejected wherefore research and development concentrated on automation of specific parts of a mine. Thus automation was never really an object by itself but rather offered perspective for reducing costs through a more efficient utilization of men and machines, improving safety and reducing the workload in the incriminating environment of an underground mine. Therefore robust instrumentations for receiving different essential data, safe ways of communication and central control stations needed to be developed and tested on site. Process computers were introduced step by step for reducing down-times and for synchronizing work above and below ground. Often the efforts could only be used in very few parts of the mine, so that the perspective of a merely partly automated mine turned out to be a more realistic one.

Automation; Coal Mining; Germany

043. Science in Islamic Societies, Globally and Locally

Mulla Farid al-Din ibn Hafiz Ibrahim Dehlawi: The Question of Scientific modernity

Gulfishan Khan, Aligarh Muslim University, Aligarh, India

This paper addresses some important questions pertaining to ushering in of the scientific temper in India during the early modern era. An attempt has been made to shed light on the multifarious roles of astronomer-scientists in the contemporary social milieu. As an astronomer he was a time specialist. He was a man in charge of Islamic temporal system in all its phases namely calendrical, ceremonial and chronological. The role of astronomer/astrologer called munajjim would be studied in the same three temporal frameworks. What were his qualifications and how was the munajjim trained are also other important questions addressed. The paper would focus on the scientific contribution of preeminent astronomer/astrologer of his day, Mulla Farid al-Din ibn Hafiz Ibrahim Dehlawi, the royal astronomer of Emperor Shah Jahan and his scientist brother and astrolabe-maker Mulla Shaikh Tayyab. He is the author of *Siraj al-Istikhraj*, “The Lamp of Astronomical Observations” (Bodleian Library, Oxford, Persian Manuscript, Fraser, 180) a hand-book for the professional astronomers which shows that with his diverse functions astronomer-astrologer remained extremely influential in Mughal court-culture and aristocratic society. He was also proficient in the occult sciences of divination and geomancy. Casting of horoscopes for the emperors, members of imperial family and other ruling elite remained a major preoccupation. Construction of chronogram called *tarikh* to commemorate any event such as victory in a war, marriage of a prince, were the other desired activities of an astronomer. Equally significant part of his profession was prediction of auspicious and inauspicious hours and days of the year, deciding the moment for an action or abstention for his elite patrons. Thereby, astrology, a completely unscientific construct was perceived to be a vital component of an astronomer’s task. Thus the science of astronomy remained embedded in the science of astrology and astrology along with astronomy was considered a prestigious science. Despite the existence of multiple astronomical traditions mainly the Greek, Indian and Persian, which continued to coexist, and also nourished each other no new discoveries resulted. Excessive preoccupation with preparation of imperial horoscopes, birth-charts, predicting the auspicious hours for royal ceremonies the situation was definitely not conducive for the beginning and inception of the scientific modernity in medieval India.

Mulla Farid, Siraj al-Istikhraj, astronomical tables, Mughal court culture

The development of didactic poetry about science in late al-Andalus and the Maghrib

Miquel Forcada, University of Barcelona

Although there are some examples of didactical poetry about science dating from the 9th and 10th centuries in al-Andalus, the genre begins to flourish from the 12th century onwards. One of the factors that explains this phenomenon is the reception of Ibn Sīnā's *Urjūza fī l-ṭibb* in the mid-12th century, which seems to have stirred the scholar's interest for this kind of texts. The number of *urjūzas* (didactical poems written in *rajaz* metre) about scientific matters and their commentaries grew considerably and the didactic poetry became a widespread tool for scientific education. In much the same way as in other Islamic regions of the *Dār al-Islām*, the flourishing of the *urjūza* and other forms of didactical poetry in al-Andalus and the Maghrib coincided with the establishment of the *madrassa*. Although there are many editions and studies about didactical poetry on science, we still need to know more about the genre and its diffusion in the learned circles of Western Islam. The paper will examine the role that didactical poetry on science played in the transmission of knowledge from the 13th century onwards and the intellectual locales in which this genre flourished.

Islamic Science; didactic poetry

Al-Bīrūnī's Mappings of the Earth and the Heavens

J. Lennart Berggren, Simon Fraser University

One among al-Bīrūnī's many interests was investigating methods for mapping the heavens and the earth. His treatments of these topics include his treatises *Projections of the Constellations* and *Making Spheres Plane* and his *Istī'āb al-wujūh al-mumkina fī ṣan'at al-aṣṭurlāb*. This talk will be devoted to an exposition of some of his remarkable discoveries in this area, their context among his contemporaries and earlier writers, and something of the subsequent history of these mappings

Biruni; cartography; mappings; astrolabe; world maps

On "Knowledge of the Cosmos," by Qaṭṭān al-Marwazī

Kaveh Niazi, Stanford Online High School

A prominent scholar of the Islamic world Qaṭṭān al-Marwazī (1072/1073 – 1153 CE) is known to have written prolifically on literature, medicine, engineering, and astronomy. His sole surviving work, however, is a Persian text on astronomy, the *Kayhān Shinākht* ("Knowledge of the Cosmos"). In this work al-Marwazī discusses common *hay'a basīṭa* topics such as the configuration of the heavens, and the layout and dimensions of the various climes of the Earth, though he includes other material such as a list of religious festivals, and atmospheric phenomena as well. The work is divided into three sections: On the Heavens (in nine chapters), On the Earth (in three chapters), and On the Calendar and the Passage of Time (in three chapters). The present paper examines al-Marwazī's work, particularly regarding his discussion of the configurations of the heavens and the earth and discusses its significance with respect to the tradition of astronomical writing in the Persianate lands of eastern Islam.

Geographical Coordinates in the western Indian Ocean: Transmission of Knowledge from Antiquity to the Late Middle Ages

Marina Tolmacheva, Washington State University

Geographical Coordinates in the western Indian Ocean:

Transmission of Knowledge from Antiquity to the Late Middle Ages

Arab geography provides the bulk of pre-modern recorded knowledge of the Indian Ocean. Early Arabic astronomic geography offers selective translations of Ptolemy's astronomic tables and general principles of cartography. Ptolemy's Geography (c. 150 AD) was the original source of the coordinates of latitude and longitude found in the 9th-century Arabic works listing selected coastal locations on the Indian Ocean littoral. Islamic descriptive geography largely ignores the coordinates and uses travel distance measurements for positioning of settlements, including those located on the coast or island. This preference is especially clear in the Geography of al-Idrisi, where locations of cities and ports is presented in the narrative according to distances measured in days of travel overland or by sea.

Cartography, and especially al-Idrisi's maps, provides another means of determining location of a point. Some early Arabic geographies include indications of developing narrative passages from cartographical evidence at their disposal. Some post-Idrisi Arabic geographies use his narrative data and add previously unavailable astronomical coordinates. The paper will analyze a selection of coordinates pertaining to the East African coast of the Indian Ocean as transmitted (1) from the Greek to the early Arabic geographical works and (2) from Idrisi to Ibn Sa'id and Abu'l-Fida', comparing their narrative and cartographical data.

Idrisi, Ptolemy, Ibn Said, coordinates, longitude, Arab geography

Thābit ibn Qurra's *Restoration of Euclid's Data*

Nathan Sidoli, Waseda University, Tokyo

Euclid's *Data* (*Kitāb Uqlīdis fī al-Mu`ṭayāt*) is the first treatise in most of our manuscript sources for the collection of works that circulated in the medieval period under the title of *The Middle Books* (*al-Mutawassīṭāt*). Despite the fact that this work had originally been composed as a treatise in pure geometry for facilitating geometrical analysis, it had been repurposed by scholars like Heron and Ptolemy as a foundation for numerical computation. Hence, by the time it was translated into Arabic in 9th century Baghdad, it was being read as a foundation for these two, sometimes conflicting, mathematical practices. In this talk, I will discuss the differences between the Greek text and Thābit's *Restoration*, with particular attention to translation choices and how they reflect the ways that the Baghdadi scholars were appropriating and modifying Greek mathematical concepts and practices.

Greek mathematics, Islamicate mathematics, Arabic mathematics, Euclid, Thabit

Scientific Exchange at the Early Ottoman Court in Istanbul and Connections with the Veneto

Robert G. Morrison, Bowdoin College

In the history of science in Islamic societies, the Ottoman Court following the conquest of Constantinople saw the confluence of a number of scientific traditions. Scholars from Samarqand, working in an intellectual tradition with a genealogy that stretched back to the Maragha Observatory encountered Jews and Byzantine Christians, among others. This blending of scholarly traditions created a fertile environment for scholarly exchange. This presentation will use the career and oeuvre of Moses Galeano/Mūsā Jālīnūs (d. after 1542) as a window on to this fascinating intellectual world. The presentation will take a particular interest in the way Moses Galeano might have been affected intellectually by his time in the Veneto and by his acquaintance with texts written in Latin. Two of his writings, a the medical text in Ottoman Turkish and a Hebrew text entitled Puzzles of Wisdom (Ta'alumot Hokma), indicated some familiarity with European texts that were not available in Hebrew and/or in Islamic languages. My conclusions will address the extent to which Galeano was operating in a Renaissance context.

Islam; Ottoman Empire; Veneto; medicine; astronomy

044. Integrated History and Philosophy of Science: Symposium of the IUHPST Joint Commission

Fritz Zwicky: Pluralistic Methodology behind Dark Matter and Neutron Stars

Alan Heiblum Robles, Independent scholar

Fritz Zwicky (1888–1974) is best known to scientists and historians of science for his scientific work in observational and theoretical astronomy. He detected more than a hundred supernovas, offered a first detailed characterization of them, and coined the very term “supernova”. Additionally, in 1934 he predicted that cosmic rays would be formed in the process of supernova-formation and that the remnant should be a star made of neutrons. Moreover, in 1933 he noticed a gravitational excess in the Coma cluster of galaxies and interpreted it as an indication of the presence of a “dark matter” existing in huge quantities.

However, his methodological views are less known and his philosophical ideas did not receive favorable reviews. Here, I will show how Zwicky’s methodology, which he named the “Morphological Method of Direct Intuition”, may constitute an intriguing contribution to epistemic pluralism. His “morphological approach” was based on one core insight, namely his “principle of flexibility of scientific truth”: “No statement that is made in finite terms can be absolute.” Based on his “conviction that there are more things in the sky than even the most imaginative human mind can divine”, this principle was intended for preventing the loss of creative solutions. In more operational terms, Zwicky’s approach amounted to a conscious policy of open-mindedness: “one may choose any axiom or absolute statement others believe in, deny its absolute truth value and proceed to generalize it, confident that one will thus produce new discoveries and inventions.” With inspiration from Zwicky, I offer a pluralist account of science building on the main lines of Paul Feyerabend’s pluralism, namely proliferation and conservation.

Pluralism; Cosmology; Zwicky

On the Social Epistemology of the Historical Development of Ambiguous Concepts in Physics

Daniel Jon Mitchell, RWTH Aachen

Historians are, at bottom, storytellers. If plot closure—or put more simply, an “ending”—is an element of a good story, then how do we approach the history of ambiguous concepts in physics where multiple plot lines are left unresolved? I present two case studies that underline the importance of social epistemology in the narrative. The first relates how practices of dimensional analysis and associated concepts of ‘dimensions’ diversified through theoreticians’ attempts during the late-nineteenth century to make them intelligible to experimental physicists and telegraph engineers. The second explores the meaning of the ‘virtual particle’ via the mid-twentieth century oscillation of the Feynman diagram between a calculational and a representational tool. In each case I examine how overlapping communities with significant shared interests yet different epistemological norms played a role in the emergence of an ambiguous physical concept.

"Physical concepts"; "Dimensional analysis"; "Virtual Particle"; "Feynman diagram"; "Social epistemology"

Towards a historical analysis of concept dynamics

Friedrich Steinle, Technische Universität Berlin

Concepts form a specific and fundamental level of scientific (and everyday) knowledge, with its own characteristics and challenges. While we do have some historical studies of long term developments of scientific concepts (mass and space, for instance), it is only recently that attempts have been taken to grasp and understand processes of concept formation in detail. We don't have a profound understanding yet of the dynamics of concepts – of how and why new concepts have been framed, stabilized, established, and in some cases disappeared again. Given the specific epistemic level of concepts, analysis of those questions requires specific approaches. In my talk, I shall discuss some of the historiographical issues that come up here as well as questions to which particular attention should be paid. I shall illustrate those considerations by sketching historical cases from the history of electricity and magnetism.

Scientific concepts; History and Philosophy of Science; electromagnetism

The significance of the not yet determined: The case of magnetic inclination

Georgescu Laura, University of Groningen

The history of the geomagnetic effect of magnetic inclination is usually told as an unproblematic narrative. Magnetic inclination as an effect was discovered and its corresponding concept was formed. According to this narrative, there is no dynamics of conceptual formation. In this paper, I challenge this narrative. I show that the process of conceptual formation is convoluted, lacking determinacy, and constantly contested by the agents involved in the production of knowledge about magnetism and electromagnetism. This is the case even for what we take to be the more straightforward cases of conceptual formation, such as that of magnetic inclination, where the concepts involved appear to capture directly observable properties of the world. In other words, I take it that, as far as the concept of magnetic inclination was an object of research with scientific

salience, it was an indeterminate concept, and necessarily so: what it showed about magnetism, how it was best described, and what its corresponding representational unit was were all open questions either directly or indirectly addressed. It is only retrospectively that we settle for a fixed, well-determined notion of magnetic inclination. If this is the case, then conceptual indeterminacy turns out to be not a shortcoming of the practice of scientific conceptual formation, but rather a productive, perhaps even necessary, component of it. Questions about a not-yet-determined concept of magnetic inclination pushed research forward, from the seventeenth century onwards, not only in what we would now identify as the discipline of geomagnetism, but also in the initial discussions about electromagnetism in the nineteenth century. Although the concept of the Earth's magnetic field can be argued to have led to the demise of magnetic inclination as a concept worthy of both scientific use and pursuit, magnetic inclination was itself productive in the articulation of the concept of magnetic field. In the attempt to articulate the significance of a concept's indeterminacy for research, I build on insights from Rheinberger's (1997) conceptualisation of epistemic things (but, by locating the problem in the conceptual realm, also necessarily depart from Rheinberger's position), and from Rouse's (2003, and especially 2015) radical discussion of the process of conceptual articulation.

"concept formation", "conceptual dynamics", "magnetic inclination", "epistemic things"

The Plurality of Systems in Nineteenth-Century Battery Science

Hasok Chang, University of Cambridge

In this paper I will present a pluralist overview of the history of what I will call "battery science" for lack of a better term, from the invention of the Voltaic pile in 1799 to the late nineteenth century. This was a phase of science with undeniable importance, creating steady electric currents and electric circuits, stimulating the discovery of electrolysis and electromagnetism, supporting countless technologies including the telegraph and electric lighting, and leading to fundamental theoretical developments ranging from Ohm's law to electrochemical dualism.

Historians have paid scant attention to this set of developments as a coherent body of scientific and technological work. To the extent that attention has been paid, it is either seen as a collection of unproblematic technological applications of basic science, or in terms of a dichotomous conflict between the "contact theory" and the "chemical theory" of the battery. I will give a new portrayal of this field, identifying and articulating four separate systems of technoscientific practice within it, which evolved in parallel and in mutual interaction: the contact-electrostatic system, the chemical imbalance system, the conservationist system, and the corpuscular-mechanical system. My attempt to reach a satisfactory historical and scientific understanding of battery science will draw from, and also stimulate, an updated philosophical pragmatism. My historical-philosophical-scientific investigation will show the potentials of a well-balanced and grounded picture of scientific knowledge, transcending an unhelpful divide between pure and applied science and a fruitless conflict between philosophical realism and anti-realism.

pluralism; battery; system of practice; realism

The ether in the 1920s: a case for pluralism in the sciences

Jaume Navarro, University of the Basque Country

In 1951, the physicist Paul A.M. Dirac called for the re-introduction of an ether in an oft-quoted letter to Nature. It was an attempt to resuscitate an epistemic object that most scientists at the time regarded to be dead and buried. The historical problem with the death of the ether is that it has never been explained. For decades, the received view of the falsification of the ether was the same story that Einstein himself had elaborated in his pedagogical explanations of special relativity. That narrative relied on the negative results of Michelson and Morley's experiments in the 1880s in their quest to determine the absolute speed of the earth in the ether. Certainly, that story has long been problematized by historians of science. Neither was the Michelson Morley experiment a turning point in experimental or theoretical physics, nor was the ether abandoned by the beginning of the twentieth century, not even by Einstein himself.

In this paper I shall pay attention to the interwar years, a period when views about the existence of the ether were more diverse and nuanced than ordinarily viewed. Partly, because the ether was never a unified concept but an epistemic object with multiple purposes; and partly because abandoning it created more problems than solutions. As I have recently argued, the emerging wireless industry and, especially, the creation of commercial broadcasting ventures opened up new spaces and publics where the ether appeared as the modern explanation for action at a distance of electromagnetic waves. The ether became, for many, synonymous of radio broadcasting and, thus, with modern science and technology. So, at the time the new physics of relativity and the quantum worked towards making the ether irrelevant, wireless broadcasting was putting the ether at the centre of the new technology.

Specifically, doing away with the ether was not an easy move when keeping much of the framework of the so-called classical physics, since action at a distance would be left unexplained. This was one of the arguments by Arthur Eddington who, while a defendant and promoter of relativity, rejected simplistic criticisms of the ether: one could do away with the ether only if concepts such as material bodies or force were also abandoned. With this example, I shall argue for pluralism in the sciences: the ether could be both preserved and rejected, only in different scientific areas and publics.

Ether; Pluralism; Physics

Reconfiguring the Conceptual Constellations of Stellar Systems: "Multiple Galaxies" and the Thought Collective of Galaxy Studies

Karin Pelte, Technical University Berlin

The historiography of post-war observational cosmology has largely been left to the accounts of the participating scientists. The picture which emerges is that of a discontinuous development driven not by theories but by technological innovation and chance discoveries. Considering this piecemeal kind of progression, astronomer M. Harwit, in 1980, stressed how astrophysical concepts, such as "black hole", served as the only stable guide lines for inquiry. Shortly beforehand, however, Soviet (astro-)physicist V. L. Ginzburg had deplored the lack of a common understanding of fundamentals and the resultant inability to agree on key research problems. Strangely enough then, fundamentals, such as concepts, could be seen both as guide lines and stumbling blocks. In my work about the longterm development (1925-1980) of the studies on multiple galaxies, I claim that, rather than an oddity, it's a matter of levels of analysis: many astrophysicists used the same key concepts, yet the latter were embedded in varying conceptual networks.

Conceptual dynamics in the physical sciences have been largely discussed in relation with theory change in different stages of experimental research. However, observational cosmology, which did

not deal with the realm of galaxies as a mere geometrical problem, had to come to grips with the growing complexity of cosmic phenomena rather than overcome inadequate theories. A complexity which, in the case of multiple galaxies, was faced not by today's centrally organized international research collaborations and their shared grasp on high tech instruments and big data, but by a small number of actors more or less bound to their local research conditions, goals and traditions and rather dependent on the publication of data gathered in different parts of the world.

In my talk I will draw attention to a period (ca. 1950-1960) in which radio astronomy as well as Soviet contributions offered new and controversial approaches to the phenomenon. Starting from Ludwik Fleck's analysis of continuous scientific developments in which the transformational potential of communication plays a major part, I will examine to what extent the respective conceptual networks were both governed by local research approaches as well as subject to ongoing reconfigurations in the communication of the thought collective.

"multiple galaxies"; "conceptual change"; "thought-collective"

Epistemic Challenges of early quantum electrodynamics and the concept of virtual particles

Markus Ehberger, Technische Universität Berlin
Adrian Wüthrich, Technische Universität Berlin

Hydrodynamics and classical electrodynamics are cases in point where epistemic or, more specifically, empirical challenges are triggers of significant conceptual developments, which help the researchers not only overcome the specific challenges but also advance the field on other fronts (Darrigol 2008, Steinle 2009).

We will review the main characteristics of epistemic and empirical challenges and discuss to what extent they can also be found in early versions of quantum electrodynamical theories. For instance, Furry and Oppenheimer (1934), in their attempt to relate quantum field theoretic considerations with Dirac's hole theory of electrons and their positively charged counterparts, grappled with describing systems with an indeterminate number of particles. About 15 years later, the version of the virtual particle concept as introduced by Richard Feynman would make such systems describable rather easily. For instance, with the aid of Feynman diagrams, the first order corrections to the Coulomb interaction of two electrons due to vacuum polarization can be pictured by an electron--positron "loop" inserted into the diagram for the uncorrected Coulomb interaction. This helps researchers refer to processes which involve entities that do not "really" exist but still have observable effects.

Our attempt to apply the notions of epistemic and empirical challenges from case studies of the 18th and 19th century to a central episode of modern physics of the 20th century is an instance of an iterative mode of history and philosophy of science, in which we hope not only to understand better the role of concept formation in the specific cases but also to develop further our meta-concepts for the analysis of such cases (cf. Chang 2011).

history of modern physics; quantum electrodynamics; concept formation; epistemic challenges; iterative mode of history and philosophy of science

045. Science and Empire: New localities - New circulations

Modernising maternities and motherhood: the missionary intervention

Dr. (Ms) Kamlesh Mohan, Punjab university, Chandigarh

The central argument in my paper is that the missionary project of annexing domestic spaces, discipline and reforming maternity, notions of motherhood, infant care and child rearing practices in colonial India especially Punjab was two prompt. It involved not only medicalization of birth but also replacement of Indian cultural values by evangelical values and western family model. Grafting of European scientific knowledge and medical innovation was an integral part of their project. Pursuit of their agenda woman medical missionaries names Edith Brown, Jessica Carleton and Sarah Hewlett founded hospitals which served as moral text books for inpatients and medical schools for training India's own daughters and disciplining dies for facilitating the process of modernization.

Maternity and modernization; European scientific knowledge; missionary agenda; medicalization of birth

Epidemics and Natural History in the Colonial Encounters of South and South-East Asia

John Mathew, Indian Institute of Science Education and Research (IISER), Pune

This paper examines the local contexts of two epidemics, one before and the other after the Great War (1914-1918), the plague of the 1890s in South East Asia and South Asia and the great influenza that extended to South Asia in 1918. In so doing, colonial considerations, particularly those of Britain in its colonies of India and Hong Kong and the French in their protectorates in Indo-China will be placed in comparison and contradistinction. Natural history, particularly in light of the elucidation of germ theory (garnering nearly half the awarded Nobel prizes in medicine in the first ten years of the prize's existence) through the role of animal vectors and hosts will be a key consideration in the paper, as well as that of individual competitors in the race for scientific posterity, including the Swiss-born French physician Alexandre Yersin, who co-discovered the plague bacillus with the Japanese bacteriologist Kitasato Shibasaburo, each under competing colonial dispensations. Yersin, working in Hong Kong, then spending half a century in French Indo-China while transgressing imperial frontiers again to follow the plague in Bombay, is a classic example of a border-crosser in an age of colonial contest, conducting his research at the 'edge of empire' (as employed by the historian Maya Jasanoff). It is in this Indian Ocean zone of political jockeying between and consequent co-constitution of the British and French empires that social worlds modified by epidemics will be considered.

Epidemics, Natural History, Colonialism, South Asia, South-East Asia

Monkey Business: The construction and internationalization of primate research at the Pasteur Institute in French Guinea (1922-1941)

Marion C. Thomas, University of Strasbourg

In the early 1920s, at the height of French colonialism, the Pastorian Albert Calmette, a staunch Darwinian, launched the creation of an overseas Pasteur Institute in Guinea, which used apes as its central research model. A scarce and expensive resource in the Metropolis, apes were abundant and accessible in France's African colonies, and as such reinforced the attractiveness of the French Empire by serving as a new raw material to be exploited. I will show how the founders of Pastoria, as the Institute was called, aimed to make it the hub of ape studies whether biomedical, physiological, psychological or ethological. Thus, apes embodied an experimental model that not only crossed disciplinary boundaries but also bridged the lab-field divide and went on to intersect with issues of race, gender, and colonialism. I will then explore the ways in which Western knowledge appropriated local knowledge, and expose the forms of power and recognition at stake. Indeed, colonial as well as foreign scientists who visited Pastoria consistently relied on indigenous peoples as carers, nurses, and laboratory assistants at the chimpanzee facility, as well as porters and guides for those who ventured out into the wild. However, these scientists hardly ever credited the contributions of these indigenous people to simian knowledge and upheld their beliefs in white intellectual superiority. They also took care to distinguish their newly certified expertise from other forms of knowledge deemed inferior. Finally, I show how apes, whether subjected to biomedical or psychological experiments, were not only enrolled in the French colonial ideology of the "civilizing mission", but were sometimes also used as a means to belittle the native population.

Primatology, Overseas Pasteur Institute, French Colonialism

Natural History as a medium of intercultural translation: Science in the Danish-Halle Mission, c. 1706-1813

Niklas Thode Jensen, Danish National Archives

In the early eighteenth century the protestant Danish-Halle Mission in Tranquebar, South India, emerged as a local centre for the production and distribution of scientific knowledge. The aim of this effort was both to facilitate evangelization and teaching locally and in Europe, and to gain financial and political support from global and local sponsors. However, as the eighteenth century wore on the way science was understood and practised in the mission changed significantly. The missionaries' interests in science adapted to the arrival of Linnaean taxonomy in India via Tranquebar and its new mode of field research. At the same time, ideas of Physico-theology and Orientalism changed the missionaries' way of communicating science with the local Tamil population. Recent research has suggested that in this period at the end of the eighteenth century nature came to play a particular role for the mission as a medium of intercultural translation and communication.

In this paper I will investigate how the use of science as a translating medium changed in the Danish-Halle Mission through the eighteenth century. I will suggest that nature, or science as knowledge of nature, came to play a role as a less sensitive "zone" or space of interaction between the Halle missionaries and the Tamil population. Through this zone, the missionaries could approach the neighbouring and much more contentious zone of religion where their ultimate goal of conversion was situated, without risking major confrontations with the Tamils over religious issues. I will show how the missionaries employed scientific texts, objects and instruments as a medium for translations in two directions: first of Indian categories, culture and objects from India to Europe, and later increasingly of Christianity, European ideas and objects from Europe to India.

Looking back to the «Science and Empires» project in its early years

Patrick Petitjean, SPHERE - Université Paris Diderot

More than 27 years ago, the colloquium «Science and Empires» was organized at UNESCO, Paris, April 1989, leading to the Science and Empires network.

It is interesting to look backward to the Colloquium introduction and to other publications during the first years of the network, in order to confront them to the new intellectual scene, which changed so much these last years.

Needham's ecumenical science was shared by many scholars, but unquestioned. It had a fundamental unthought-of about Western modernity: its claim to universality and its predatory ontology over nature and other civilizations, its conception as the obligatory path for the history of humankind. It ignored most of the radical criticism of science of the 1970s.

New studies, in the present contexts, allow us to evaluate the relevancy of our initial project
Three fields would help to do that:

- 1- History and post-colonial studies (Subaltern History, Global History, Connected History, etc.).
- 2- Ecological criticism of modernity and of scientific reason
- 3- The forms undertaken by the new globalisation and its social and ideological consequences

I brought into the discussion some scholars : Sanjay Subrahmanyam (*Histoire globale de la première modernité. Leçon inaugurale au Collège de France*, Fayard, Paris, 2014) , Dipesh Chakrabarty (*Provincializing Europe: Postcolonial Thought and Historical Difference*, New Edition. 2007, Princeton University Press), Christophe Bonneuil (*L'Évènement anthropocène*, Paris, Seuil, 2013) and Achille Mbembe (*Critique de la raison nègre*, Paris, La Découverte, 2013). In different ways, they share a common rejection of Western modernity and ethnocentrism and they raise the same question: To what extent colonialism and racism are constituents of the modern science worldview?

science; imperialism"; modernity; ethnocentrism; colonialism

Global Gardens: Imperial Russian Botany between Europe and Asia, 1630-1760

Rachel Koroloff, New York Botanical Garden

This paper, based on research conducted for my dissertation and monograph, will focus on the influence of Russian imperial infrastructures on the development of scientific practice, more specifically botany, in St. Petersburg, Moscow, and Astrakhan' in the seventeenth and eighteenth centuries. It will show how Muscovite approaches to the natural world, including the collection and cultivation of medicinal herbs in apothecary gardens helped to create intellectual frameworks upon which botanical practice was later structured. It was by borrowing heavily from Russian imperial infrastructures and by founding scientific practice on scientific expedition to Siberia, the Far East, the Pacific Ocean and to Central Asia, that the Russian Empire developed its own, recognizably scientific tradition in less than a century.

Moreover, this paper will describe how these Muscovite foundations helped to determine the itineraries through the landscape that would eventually come to influence Russian scientific practice. The pride of the St. Petersburg Academy of Sciences throughout the eighteenth century was the richness of its natural historical and botanical collections, indeed, the foundation of imperial Russian science was laid along the roads through Siberia and beyond.

By outlining these itineraries of collection (the routes taken by traveling naturalists and scientific

expeditions) and their respective spaces of cultivation (gardens, herbaria, published and manuscript floras) I will argue that movement through space clearly influenced the production of botanical knowledge in Russia.

The production of botanical knowledge through Russia's itineraries of collection, cultivation, and exchange, ultimately transcended the boundaries of the Russian Empire itself, moving well into the Ottoman, Persian and Qing territory. It is through the study of plant collection and cultivation, from the apothecary to the botanical tradition, that we see how Russia worked to style itself, well before the Petrine revolution, as a botanical broker, intellectual liaison, and crucial go-between for Western Europe and Asia.

Russia; Empire; Garden; Botany; Medicine

046. International Circulation and Local Scientific Traditions. Human Diversity, Heredity & Races in the 20th Century: Latin-America, Europe & the United States

The genetic of Brazilian northeastern population, 1950-1980: making up populations with heredity, race and culture

Ana Carolina Vimieiro Gomes, UFMG

The aim of this work is to investigate the population genetic studies on the Brazilian Northeastern population, from 1950s to 1980. It analyses the themes and research programs, theories, practices, methods and the taxonomies developed to determine the genetic composition of the "northeastern" people. The first investigations on the northeastern population started with Salzano's studies on blood groups and was later expanded in a series of studies conducted by the group of geneticists around Newton Morton, from University of Hawaii, helped by Brazilian scientists from São Paulo, Paraná and Bahia such as Henrique Krieger, Ademar Freire-Maia e Eliane Azevedo, respectively. The studies were grounded on the idea of the peculiar racial admixture, evolution and demographic pattern of the northeastern. Northeastern was deemed a special population for genetic studies for its genetic diversity caused by three-racial miscegenation as well as its high fecundity, endogamy, consanguinity and child mortality rate. Typical cultural and social conditions of the region – such as pre-industrial life conditions, pattern of marriages and traditions of use of surnames, for instance – were also taken into account in their analysis. My argument is that northeastern population was made up in terms of genetic features. Scientists mobilized hereditary, racial and socio-historical views in order to situate the genes in space and time, thus defining biological boundaries for that population. The present work shed some light on new medical and scientific approaches concerning racial categorization, genetics and miscegenation and its relations to a recurrent cultural representation of Northeastern people.

history of genetics, race, population

Place, Race, Genome: 'The Polynesians' in Deep Historical Perspective 1756-2017

Bronwen Douglas, The Australian National University

This paper traces shifting connotations of the reified racial category 'The Polynesians' in ideas of human difference, race, and genetics in diverse geopolitical or disciplinary contexts over more than 250 years. 'Polynesia'—from Greek poly- (many) and nēsos (island)—was conceived in the mid-18th century as a descriptive regional toponym for 'everything contained in the vast Pacific Ocean'. Its

subsequent geographic referents varied widely in French, German, British, Italian, Russian, and US cartography until standardized globally in the 20th century to denote the 'Polynesian triangle'. The 'Polynesian race' and its essentialized human constituents 'the Polynesians' were invented by a French geographer in 1804. From 1832, they were construed as the apical element in the French tripartite geo-racial division of Pacific Islanders into 'Polynesians', 'Micronesians', and 'Melanesians'—the global norm after 1900. The term 'the Polynesians' has usually been racially inflected, whether blatantly or tacitly, including in some ongoing Indigenous usages. 'The Polynesians' have persistently been idealized for physical beauty and liberal sexual practices in idyllic tropical settings (the 'Noble Savage') and romanticized as navigators par excellence ('Vikings of the sunrise'). They have also consistently been graded more highly than other reified Oceanian races—notably 'the Melanesians' and 'the [Aboriginal] Australians'—as physically, morally, politically, and socially 'superior' or 'more advanced'. In practice, such ambiguous evaluations did not save most Polynesians from colonial encompassment and ongoing exploitation or some from dispossession and marginality. Moreover, if 'the Polynesians' topped regional racial hierarchies, they were consistently consigned to relatively low (but never the lowest) strata of global racial and civilizational rankings. The paper charts transformation and recursion in varied disciplinary recourse to 'the Polynesians' across overlapping imperial, local, national, regional, or transnational settings. The disciplines are natural history, geography, cartography, linguistics, comparative anatomy, physical and biological anthropology, human biology, archaeology, and genetics. The paper culminates in a critique of problematic invocations of the 'Polynesian motif' in some recent genetic and genomic studies seeking evidence for the settlement of Oceania and the Americas or the origins of the Pacific Islanders and the Americans.

Polynesians; race; place; genomes; history

Metamorphosis of the concept of “race” in French hemotypology (1950's-1980's): between Europe and South-America

Claude-Olivier Doron, University Paris Diderot

Historiography used to claim that the notion of race, as it had been developed in physical anthropology, had been rejected by anthropology after 1945 and substituted by the notion of population in biological anthropology.

These ultimate decades, different works have shown how this paradigmatic break had to be reevaluated and how, instead of a radical break, one could identify a complex process of translations, continuities and displacements. Far from rejecting the concept of “race” itself, population geneticists and medical geneticists, as R. Fisher, W. Boyd, T. Dobzhansky, A.E Moutant, pretended to develop a more scientific concept of “race”, based on genetics material (as blood groups, enzymatic polymorphisms and so on), that should replace physical anthropology's concept. And the relation between these two concepts was far more complex than a relation of total opposition.

In France, such a process of translation, circulation and reformulation between physical anthropology and population genetics, and how it evolved between the 1950's and the 1980's, is perfectly illustrated in the work of the main figure of hemotypology Jacques Ruffié, who was the director of the Centre d'hémostypologie in Toulouse. This institution launched studies all around the world to analyze the genetic composition of various populations. Many focused on South America, which turned to be one of the main laboratories for this new knowledge of human biological diversity.

This is why I'll especially focus on how Ruffié and his colleagues of the Centre d'hémostypologie studied South American countries, from the 1950's to the 1980's, and how the knowledge they produced on these populations was related to their work on various other groups in Europe and elsewhere. Relying mainly on their published works and on the archives materials of the Centre d'hémostypologie, I expect, through this case study, to illustrate how the concept of “race” has been re-worked, transformed and translated, between physical anthropology and human population genetics, all along this period.

Conceptions of eugenics in Brazil and their relationship with sanitarism and hygienism: the trajectory of Belisário Penna

Leonardo Dallacqua de Carvalho, Casa de Oswaldo Cruz/FIOCRUZ

Since its introduction, Galton's science has taken various forms of appropriation in the context of its employment, many of them linked to political, social or cultural imperatives. The concept also obtained different meanings moving towards a "positive" eugenics aiming encouraging the reproduction of the "well-born", "preventive" concerned with the eradication of social poisons and "negative" with restrictive practices or control against those considered inadequate. The adoption of such terms would depend on the comprehension of science of a particular group in the understanding of eugenics.

In the worldview of Brazilian intellectuals, eugenics served as an alternative to the attempt to solve national problems and was far from being a conceptual consensus. Noting the effects of the circulation of eugenics knowledge and its appropriation around the world, the present study aims the counteracting of eugenics conception of Belisário Penna and Renato Kehl in view of Brazilian sanitation agenda.

My presentation aims to enlighten on the path taken by Belisário Penna who maintains his eugenic ideals articulated to his sanitarian and hygienist militancy. For this, we intend to discuss his dialogue with the production of the British eugenicist Caleb Saleeby, who, with his work *Parenthood and race culture* an outline of eugenics, published in 1909, had repercussion in the eugenic movements of Latin America, mainly aligned to the combative discourses to racial poisons and venereal diseases. Thus, we have at disposal the conjugation of Brazilian's eugenic the mixture of conceptions connected to an international network represented by Galton and Saleeby in England, Fischer in Germany and Davenport in the United States. The manipulation of different models of eugenics represents the search of intellectuals in the attempt to decipher the enigma that was Brazil, a country concerned with its introduction to modernity. Such theoretical plurality offers the dimension of the circulation of eugenics scientific knowledge in the writings of Brazilian's intellectuals of great appeal such as Renato Kehl and Belisário Penna, individuals directly involved with Brazilian governments and responsible for national identity projects.

Belisário Penna; eugenics; race

A Hybrid Science of Racial Intermixing. Italian Population Scientists, Mexican Anthropologists and the Promotion of Latin Eugenics in the Interwar Period

Luc Berlivet, CNRS & EHESS

The aim of this presentation is to shed light on a collaborative, scientific investigation into the Mexican Indians that took place in the early 1930s. The prime mover in the organization of the expedition was an Italian research group: the Italian Committee for the Scientific Study of Populations, that had been established by Corrado Gini, a statistician and eugenicist with strong political connections, in 1928. As one knows, demographic policy ranked high up on Mussolini's political agenda, whilst the public interest in eugenics extended well beyond the fascist intellectual elite. As political connections translated into financial support, the Italian Committee was able to launch a series of investigations into extremely diverse populations, with the aim to study the contrasting effects of "isolation" (i.e. inbreeding), on the one hand, and "racial hybridization", on the other, on both the quantity and quality of human populations. Among the populations of major interest to them were the Mexican Indians, who had been at the centre of political and intellectual

attention in their own country since the aftermath of the Mexican revolution. Mutual, if not entirely similar, scientific and political interests therefore underlay the large scale Italo-Mexican investigation into a wide range of Indian communities that was undertaken in 1933.

After clarifying the political context of the expedition, the presentation explores the motives of both parties to the scientific investigation. It then goes on by detailing the multi-pronged, all-encompassing methodology drawn up by Gini to control for the different kinds of variables that impacted the development of human populations. The practicalities of the expedition are also studied, while special attention is paid to the dynamics of the collaboration between the Italian and the Mexican scientists on which it rested. The role of go-betweens in liaising between the scientists and the Indians is brought forward and discussed, as is the central position occupied by the Indians themselves, being both the “object” of the research and “informants” on many crucial aspects, such as their living-conditions, history, etc. Finally, the presentation concludes with a reflection on the manifold legacy of the investigation, both in Italy, in Mexico and at the international level.

eugenics; race; Mexico; international circulations; anthropology

Otto Klineberg's critiques of intelligence testing and his view of Brazil as a “racial laboratory”

Marcos Chor Maio, Fundação Oswaldo Cruz

Title: Otto Klineberg's critiques of intelligence testing and his view of Brazil as a “racial laboratory”

Abstract: Otto Klineberg, professor of psychology at Columbia University, held that intelligence tests were a tool for legitimizing racial hierarchies. He conducted numerous studies of the relations between blacks, whites, Indians, and immigrant groups in the United States and Europe in which he stressed that environmental considerations trumped racial factors. Klineberg came to see Brazil as a prime setting for demonstrating that intelligence testing lacked any scientific basis. The present article has a threefold focus: three studies conducted by Klineberg between 1927 and 1935; his experiences in Brazil from 1945 to 1947 as a professor at the University of São Paulo, where he tried to investigate the relation between intelligence testing and socioeconomic conditions at schools in Rio de Janeiro; and his post-World War II work at UNESCO, when many were still arguing that intelligence tests were an appropriate way to measure so-called innate traits.

Keywords: intelligence tests; racism; Otto Klineberg; UNESCO

Designing the Imperfect body: tracking eugenics transnational networks in the early 20th century (Brazil and United States)

Pietra Diwan, Pontifícia Universidade Católica de São Paulo

At the beginnings of the 20th century, most of developed European countries and United States were thinking about its growing populations and the risk of degeneracy through the mixing of races. Eugenics thought found a fertile soil to grow and develop under the perception of human decay in a moment of consolidation of national-states and formation of the welfare state. Biopolitics were in place systematizing politics and laws to ensure a healthy growth of the population and its efficiency. In Latin America experiences in national-state's formations has its own particularities. However, the affirmation of nation through population (keeping their good offspring) were common and must of the times inspired by European countries, but not only. Our interest is to enlighten the exchanges between eugenicists in the United States and in Brazil.

Those were made specially through missives but also in personal contacts and participations, as during the Third International Eugenics Congress (1932), among others. In addition, the Eugenics Record Office (ERO) at Cold Spring Harbor (NY) was a large and effective center for eugenic propaganda whose communicate with several countries of the world, including Brazil. This presentation will track the exchanges between Brazilians and Americans, with focus in the descriptions about the imperfect body, and its implications in the debate about race, but not only. Eugenics were only possible with the clear and straight definition of what was considered normal and what was considered abnormality. Imperfection, ugliness, unhealthy were all definitions not always based on scientific methods and research. The scientists' believing in the new conclusions of Genetics regarding heredity and human development saw it as a hope to fix a society threatened by deviation and the nation's future condemned.

The main target of eugenicists was the defective, in several types of descriptions: from the feeble-minded to idiots, passing by ethnicity and pathologies. Brazil made different types of categorizations. A different path will show that Brazil couldn't apply sterilization laws in the same way as several states in the United States. Brazil has been created the myth of racial democracy forged by eugenicists thoughts. The soft way was accept the racial mixture but avoiding its individual's social ascension.

race; imperfection; eugenics; transnational; network

Amazonian indigenous peoples and production of knowledge on the natural history of infectious diseases in the second half of the 20th century

Ricardo Ventura Santos, Fiocruz

This paper explores how indigenous native Amazonians became "populations of cognition" in the production of knowledge on the natural history of infectious diseases in the second half of the twentieth century. My main focus is on the biomedical research carried out by Yale virologist and epidemiologist Francis Black in South America from the 1960s to the 1990s. One of the leading researchers involved in the field trials of the measles vaccines in the 1960s, Black gradually became involved in biomedical research focused on Amazonian indigenous populations. At a historical moment when vaccine development and other technologies created an optimistic scenario for the control and even eradication of major infectious diseases, interpretations derived from field investigation carried out by Black and co-investigators in Amazonia were marked by highly pessimist perspectives on the future of indigenous populations, as their biologies came to be seen as too frail to face the challenges posed by epidemic infectious diseases.

Epidemics; Amazonia; Mortality; Indigenous populations

Eugenics, Genetics and Anthropology in Brazil: from the controversies about miscegenation to the cultural interpretations of Gilberto Freyre (1929-1933)

Robert Wegner, Fiocruz

The early decades of the 20th century witnessed the emergence of eugenics movements in different countries around the world. While in the United States and Great Britain the birth of eugenics was intimately linked to the growth of Mendelian genetics, in Brazil it was physicians who, in the wake of the First World War, were attracted by the ideal of bringing about the biological improvement of the population using measures inspired by neo-Lamarckian principles. In the 1920s, other scientists joined the eugenics movement, including psychiatrists, anthropologists, and geneticists, helping to broaden its

scientific foundations. My presentation explores the controversies surrounding miscegenation in the context of the expansion of Mendelian genetics in Brazil. I focus on two geneticists from an agricultural college in Piracicaba, São Paulo, who first became involved in eugenics in 1929. Aligned with the Mendelian theory of inheritance, Salvador Toledo Piza allied himself with Renato Kehl, who deemed miscegenation equivalent to crossing different species. Meanwhile, Octávio Domingues reached the conclusion that miscegenation was healthy, a position which was more in tune with the conceptions of Roquette-Pinto. To understand these nuances in the interpretations of Mendelian theories in Brazil, it is therefore necessary to investigate research undertaken on different populations, such as the work of Alfred Mjoen, Charles Davenport and Franz Boas. In this context of transnational circulation of scientific research, the publication of *Casa Grande & Senzala* (The Masters and the Slaves) in 1933 by Gilberto Freyre marked a turning point in the debates about miscegenation in Brazil. We investigate how Freyre's ideas interacted with these researches and conclude with the argument that there is nothing in his 1930s intellectual production that could be seen as a precursor of the author who was so important to Portuguese colonialism in the 1950s and 1960s.

Miscegenation; Race; Culture; Eugenics; Anthropology

047. XXXVI Symposium of the Scientific Instrument Commission

Quantum Mechanics and Industrial Research: The Corroboration of the Casimir Effect

Ad Maas, Museum Boerhaave

Beto Pimentel, Universidade Federal do Rio de Janeiro

In our presentation paper we will discuss the instrument used for with which the first attempt at the verification of the Casimir -Effect, an important quantum-mechanical phenomenon, was attempted for the first time. The instrument, devised in 1958 by Dutch physical-chemist Hans Sparnaay, is intriguing in its simplicity of its design. To enter the realm of quantum mechanics, experimental physicists usually have to deploy very sophisticated set-ups. Sparnaay's apparatus, however, was a down-to-earth, tabletop construction. It measured the force mutually exerted at each other by two metal plates when placed at a very short distance. The magnitude of this force revealed the Casimir Effect. Another atypical feature of the experiment was that it was conducted in the research laboratory (NatLab) of the electrotechnical firm Philips. Hendrik Casimir was director of the NatLab and, Sparnaay one of its researchers. Thus, we will also examine the relations between what does this apparently esoteric excursion in quantum mechanics have to do with the commercial world of industrial research.

Casimir effect, Sparnaay, Sparnaay experiment, Quantum Mechanics

The operation of scientific instruments and machines: the use of audiovisuals in exhibitions

Adriana Mortara Almeida, Instituto Butantan/Museu Histórico

Larissa Foronda, Instituto Butantan/Museu Histórico

Oswaldo Sant'Anna Junior, Instituto Butantan/Museu Histórico

Juliane Quinteiro Novo, Instituto Butantan/Museu Histórico

Gabriela Bassan Piedade, Instituto Butantan/Museu Histórico

Millard Schisler, Photographic and Film Conservators, Studio 17

Gabriel Rodrigues Orlando, Instituto Butantan/Museu Histórico
Marília G. Almeida, Instituto Butantan/Museu Histórico
Douglas S. Bandeira, Instituto Butantan/Museu Histórico
Patricia de Filippi, Photographic and Film Conservator

The Butantan Institute Historical Museum displays scientific instruments, furniture, glassware and other objects from the twentieth century that are part of the history of research, production and knowledge dissemination of Butantan. Many instruments like the optical microscope, precision scale, calculator, egg candle, typewriter and telephone are examples of instruments whose functions are still performed by more complex and accurate devices. The presentation of these objects, contextualized by small scenarios, texts and photographs, arouses great visitor attention. However, the understanding of their operation is only possible through an educator's explanation to the visitors. Still, several processes have so far been explained only theoretically, since due to preservation issues the educators cannot handle the associated objects. A research project on the operation of Butantan historical collection of instruments is being developed in order to give subsidies to the creation of short films that show the machines working as in their original context. The films will be available in the Historical Museum exhibition and on social networks, facilitating the operational understanding of these machines to visitors and generating interest for the visit of those who do not know the museum. The Historical Museum receives many school groups, and this younger generation is, in a sense, very far removed from these technologies and their history. Bringing these objects back to life is also a way to connect them to the history, use and appreciation of these technologies and enhance their learning of contemporary instruments. The films will have subtitles and audio description for people with visual and hearing impairments. The museum educators can use the films in various ways in the educational activities, increasing the public understanding of science and health histories. We will compare this experience with other history-of-science museums that use audiovisual media for interpretation. We will present the research results and the films, proposing a discussion on the role of audiovisuals in history-of-science exhibitions in the visitors' learning experience.

Audiovisual; Instituto Butantan; typewriter; calculator; museum exhibition

Measuring Professions and Mathematical Instruments in Early Modern Europe

Antoni Malet, Universitat Pompeu Fabra

Mathematical changes in practical geometry, including specialization and the proliferation of mathematical instruments, were deeply related to changes in social structure and in particular to the 16th-century emergence of new measuring professions specializing in the measure of specific goods. They became part and parcel of the fabric of life in early modern Europe. These professions very often were also embodiments of political authority. Some attention has been paid to the increase in mathematical literacy in early modern Europe, but not much attention has been paid to the politics and the sociology of measuring. The paper focusses on one or two case-studies that reveal the ways in which bylaws and ordinances by royal and local authorities regulated measuring; how the measurers themselves participated in the coercive apparatus of the state and town; and how the standards and measuring instruments were earmarked and kept in symbolically relevant buildings. It aims to show that social conventions and social and political authority shaped conceptual change in mathematics.

instruments; measuring; early modern Europe

From working world to the museum world: the museum of topography history and cartographic engineering Keuffel & Esser theodolite's trajectory (Pernambuco- Brazil)

Bruno Melo de Araújo, Federal University of Pernambuco

The globalized world loosens the politic-administrative boundaries, allowing the movement of people, ideas, technologies, objects and capital. This process simplifies making connections in global and local scales. Focusing on a Keuffel & Esser theodolite from Federal University of Pernambuco (UFPE) held at the Museum of topography history and cartographic engineering, we are going to analyse its trajectory to identify the knowledge intermediated by it. K&E was a company founded in 1867 in the USA by German immigrants. By the year 1880, it had built its factory in Hoboken, New Jersey. In 1918, K&E acquired the control over Young & Sons and made it a department inside the company. The production at K&E ended in 1969. The K&E theodolite chosen for our study was purchased by the Pernambuco State and experienced a diversity of locations and uses (Pernambuco's state work secretary, The Engineering School, The Museum of topography history and cartographic engineering). A careful view of its journey shows the object's circulation as a central actor in the knowledge production about the cartography and topography history in Pernambuco. From our analysis, we identified the object's potential to intermediate knowledge about the global-local dynamic of a scientific instrument, about scientific practices in educational institutions and about construction of an identity of a professional community.

Theodolite; museum; cartography; surveying; trajectory

Managing and preserving scientific and technological heritage in Cuba: an urgent and arduous task

Claudia Felipe Torres, University of Havana
Lubia Diaz Bernal, University of Havana

Cuba holds a dispersed but significant heritage of scientific instruments preserved in scientific and educational institutions, such as the University of Havana, the Seminar of San Carlos and San Ambrosio, the Cuban Academy of Sciences, historical pharmacies, among others. With a clear predominance of nineteenth and twentieth-century scientific instruments, these collections are a tangible expression of the evolution of science in Cuba, the Caribbean and Latin America, and they reflect the diversity of scientific and philosophical influences experienced in our country, placed in an intense cultural and commercial cross point. They also demonstrate the deep relation between the developing of science and the emergency of the spirit of independency in our country.

However, in spite of such relevance, Cuban scientific and technological heritage is not granted a clear legal protection. It is only lightly mentioned in Cuban regulations concerning cultural heritage and there are no specific recommendations about its protection. Moreover, the management strategies developed in the institutions where these collections are preserved reveals the absence of a specifically designed approach and a heterogeneity of inventory and diffusion policies. It is probably the most fragile expression of cultural heritage in Cuba due to its little recognition both in the cultural sector and the scientific community.

As a result of recent research, a methodology specifically focused on scientific and technological heritage has been developed in order to provide institutions with a useful tool to identify, evaluate, preserve and promote their collections. This paper will present and discuss this new methodological approach and analyze the limitations in the preservation and management of this type of heritage. Some of the most important Cuban collections of scientific instruments will also be identified.

The 'personal' equations of American astronomer Joel Stebbins

Dana A. Freiburger, University of Wisconsin-Madison

In March 1901 Joel Stebbins, a graduate student in astronomy at the University of Wisconsin, sat down with the department's Personal Equation Machine from M. E. Kahler of Washington, D.C., and determined his personal equation value as 0.313 ± 0.0030 seconds based on 187 observations "taken perfectly naturally." As a new student studying in an observatory possessing an excellent array of instruments, this exercise could be seen as a logical and valuable step in learning how to operate a telescope where his personal equation numbers bespoke of heightened data accuracy. Yet did these numbers speak to Stebbins in another way – perhaps as a warning of becoming too enmeshed in learning the 'old' astronomy with its emphasis on positional information where the personal equation held an important place? Did this Kahler Personal Equation Machine with its simple clockwork mechanism appear obsolete in a field where starlight itself was now revealing astonishing new details about the universe? Given that Stebbins left Wisconsin without a degree in June 1901 to study the 'new' astronomy of spectroscopy and photometry at Lick Observatory in California, a move encouraged by his supervisor and Wisconsin observatory director George Comstock, this suggests that more than one 'personal' equation may have been in play here. My talk will look at this Personal Equation Machine and Stebbins' personal record of its use to consider how an 'old' machine might have compelled Stebbins to study the 'new' astronomy.

astronomy; personal equation instrument; education

Looking at the skies for 175 years. The Plossl refractor of the National Observatory of Athens

Dimitrios Tsimpidas, National Observatory of Athens

Lazos Panagiotis, National University of Athens, Faculty of Primary Education

The National Observatory of Athens was founded in 1842, only 5 years after the establishment of Greek state. Baron G. Sinas, a rich Greek from Vienna, was convinced by George Vouris (professor of Astronomy in the University of Athens) to assume the cost for the construction of an Observatory in Athens. The area of the hill of the Nymphs was selected as the site for the building and the construction of the Observatory began. The architect of the building was Theophil Hansen. This paper is dedicated to the 162 mm Plossl refractor of the observatory. It not only is one of the first instruments that the first Director of the Observatory, G. Vouris, brought from Vienna (and until 1901 the largest telescope of the Observatory), it is also the telescope through which Schmidt, over a period of many years, conducted the observations that led to the drawing of his celebrated topographical map of the Moon. This map was published in 1876 by the Prussian Academy and contains 30,000 calderas, 2000 of which were depicted for the first time. It was so famous at its era that it was mentioned by Jules Verne. The telescope was in use until 1958, though for long periods of time it remained inoperable due to technical problems and lack of spare parts. It was used for various astronomical observations: of the Sun, planetary (in 1879-1880, Schmidt calculated the time of Zeus' circumvolution), observation of comets, and, towards the end of its lifecycle, for observations of solar atmosphere. Recently, it was carefully maintained and now it is ready in its original position for observations during visitors' nights.

Research Institutes in Pernambuco (Brazil): disposal and preservation of science and technology heritage

Emanuela Sousa Ribeiro, Universidade Federal de Pernambuco

This paper presents and discusses the results of surveys conducted in seven research institutes of science and technology in the State of Pernambuco, Brazil (Instituto de Pesquisas Agronômicas, Instituto de Pesos e Medidas do Estado de Pernambuco, Instituto de Tecnologia de Pernambuco, Superintendência de Desenvolvimento do Nordeste, 4º Distrito do Departamento Nacional de Produção Mineral, 3º Distrito de Meteorologia do Instituto Nacional de Meteorologia e Coordenação Estadual de Pernambuco do Departamento Nacional de Obras Contra a Seca). The survey aimed at identifying scientific instruments and associated documentation that could be considered science and technology heritage. Field survey forms used were developed by GRANATO et al (2013), and the theoretical framework presented by GRANATO and LOURENÇO (2010), MENEZES (2009) and GONÇALVES (2007). These research institutions were created by the regional or federal government between the 1930s and 1960s and their researchers played an important role in academia, especially in the higher education of Natural History, Engineering and Geology. The paper concludes that, despite significant activity in these Pernambuco research institutes, they did not deliberately preserve scientific instruments associated with science and technology activities during this period. Only administrative and scientific documents were partly preserved. The absence of scientific instruments encourages reflection on the motivation of their disposal, given that although most institutions surveyed had some kind of preservation mechanism or policy, scientific instruments were systematically excluded.

Research institutes, Applied Research, Scientific Instruments, Pernambuco

From the Global to the Local: Technology Transfer from Low Earth Orbit to Alabama

Emily Margolis, Johns Hopkins University

Since 1982 the United States Space Camp in Huntsville, Alabama has welcomed over half a million children, adults, and families to play astronaut for a week. Participants "train" for space missions over a weeklong period through a mixture of classroom lessons and hands-on experience with instrumentation found on the flight deck of the Space Shuttle, modules of the International Space Station, and in the Mission Control center. The history of U.S. Space Camp reveals a unique episode of technology transfer from the global to the local, in which instruments for conducting experiments in low earth orbit and for navigating in space were adapted for pedagogical and entertainment purposes at a camp in the American South.

Through archival research and interviews with participants and program managers, I describe the U.S. Space Camp experience and contextualize it, with its dual agenda of inspiring patriotism and interest in careers in science and engineering, as a product of the Cold War. This research continues the tradition of historical scholarship on teaching laboratories, while engaging with the current discourse on science and leisure in America. Attending to the interactions between U.S. Space Camp participants and the instrumentation allows for a methodological intervention in the discipline of space history, namely the introduction of actors (children and families) omitted from traditional narratives about spaceflight and society.

spaceflight; technology transfer; pedagogy

Cultural Heritage of Science and Technology in Brazilian Universities: an introduction to the museums and collections of the Federal University of Rio de Janeiro

Ethel Rosemberg Handfas, Universidade Federal do Estado do Rio de Janeiro

This paper presents preliminary results of a PhD in Museology and Heritage (Universidade Federal do Estado do Rio de Janeiro - UNIRIO/Museu de Astronomia e Ciências Afins - MAST) about scientific and technological heritage in Brazilian universities. The research was prompted by concerns about the vulnerability and fate of objects used in the production of science and technology knowledge. Field work was undertaken at the Universidade Federal do Rio de Janeiro (UFRJ) aiming at examining why and how objects once used in research and teaching are disposed of, or instead, preserved and musealized. Issues such as the political, social and scientific contexts for constructing or dismantling laboratories, decision-making about obsolescence and preservation of science and technology objects and the conditions under which musealized collections are kept, used and made accessible were analyzed. The research draws on primary and secondary sources, including oral interviews with professors, researchers, lab technicians and museum professionals.

University heritage; science and technology; university museums; UFRJ

The three lives of the EAI 8800 calculator: from nuclear fear to the museum

Foasso Cyrille, Conservatoire National des Arts et Metiers

The second half of the twentieth century has seen a major change in scientific instruments, viz., the quasi-disappearance of the analog in favor of the digital. However, in the 1960s, it was not obvious to scientists and engineers that this revolution would erase the ancient world. We will deal with the case of one archetypal scientific instrument, the EAI 8800 analog calculator and its 'hybridization' as the EAI 8900 with digital parts. We shall describe the "three lives" of that instrument. A child of the Atomic Age and of the Cold war, the EAI 8800 was first used in the 1960s for nuclear power simulation at the French Atomic Energy Commission. It then found employment by the designers of ballistic missiles until the beginning of the twenty-first century. The 'third life' of the object, namely its presence in the Collections of the Musée des arts et métiers in Paris, will lead us to discuss the question of what artifacts we should keep or discard, a key question for curators as our choices will forever shape our scientific and technological heritage.

Nuclear science; Missile Design; Simulation; Museum Heritage

Networks of a new Microworld: the production, trade and ownership of microscopes in the early Dutch Republic

Huib J. Zuidervart, Huygens ING (KNAW)

In the seventeenth century a new kind of scientific instrument emerged: the 'philosophical instrument'. They were not devices to measure, but what they revealed gave food for thought. The microscope was one of these philosophical instruments that provided insight into a new, previously

unknown, microworld. Although the microscope was developed from the telescope in the late 1610s, it only came to fruition in the late 1650s. The instrument became even more successful after the development of the single lens microscope around 1660.

The major Dutch researcher Antony van Leeuwenhoek (1632-1723) and many other early microscopists made their own microscopes, which were never sold to the public. However, the sensational discoveries of several of these microscopists in the 1670s created a public demand for such microscopes, which in turn generated the emergence of professional microscope makers. In this new market Dutch, French, German and English instrument makers tried to get their share. In this paper, I will be examining how this professional production and trade of microscopes evolved in the early Dutch Republic, and how the ownership network of these instruments and their makers functioned to bring a locally developed product to a wider audience.

Microscopes; 17th – 18th centuries; Scientific instrument makers; Dutch Republic

How a science artist made an impact in wave theory

Jasmin Janka, Europa-Universität Flensburg

In the late 18th century E.F.F. Chladni began to travel all over Europe and showed his 'sound figures' in popular science presentations. As he said in one of his texts, his first intention was being an artist, a musician with science instruments. But later on it got clear, that his inventions in acoustic as a discipline of physic were much more interesting for his audience.

And his sound figures were an experiment with a high potential for further studies. The experiment seems simple: A plate of glass or metal was strewn over with sand and with a violin bow one generates vibrations in the plate. The sand moves to the parts where the vibration is lowest and one can see lines of sand there.

In my work I show, how the experiment evolved in the 19th century and how it influenced research in that time.

Therefore I used the method of replication. And some of the results of my research I will present in my talk: Not the only development of acoustic was advanced by the sound figures, they notably are fundamental in other fields of physics, especially for discoveries in wave theory. My own experiments and studies show, how the sound figures, done by Wilhelm and Friedrich Weber, Charles Wheatstone and Felix Savart, are one of the primary experiments for the knowledge gain of waves. I will show some experiments which substantiate my result, that the sound figures have created new findings in fundamental mechanical theory of vibration and waves.

History of acoustics; History of wave theory; History of experiments

A Device to Unveil Military Secrets: The C.I.S.E. Cockcroft-Walton Accelerator

Leonardo Gariboldi, Università degli Studi di Milano, Dipartimento di Fisica

Nuclear research in the first decade after WWII is an interesting case study for the relationship between the local and the global. The strong connection between nuclear physics and the new nuclear weapons meant that many scientific and technological results were classified as military secrets. In 1946, a new centre of nuclear research was established in Milan (Italy): the C.I.S.E. (Centre for Information Studies and Experiments). Founded as a private centre to produce nuclear electric power, the C.I.S.E. soon started theoretical and experimental research to develop new devices to measure nuclear cross-sections of the interactions between thermal neutrons and the nuclei of

elements used as fuel or as building materials for a nuclear reactor. Their first results on U-235, obtained with an ionization chamber, were published in 1950, shortly following similar partial results by several other European and Indian physicists. New researches were made with a 400 kV, 3kVA Cockcroft-Walton accelerator, built in 1951, used with a time-of-flight spectrograph. In 1954, C.I.S.E. published the measurements of total cross-sections in “an energy range, whose cross-section has not been made known until now”. It was time to unveil some secrets. One year later, following Eisenhower’s proposal for “open skies”, the “Atoms for Peace” Geneva conference decided to share nuclear knowledge for peaceful use. Since July 2016, the C.I.S.E. Cockcroft-Walton accelerator is on permanent exhibition at the National Museum of Science and Technology in Milan and is now being studied in a project to safeguard and reconstruct C.I.S.E. history.

Cockcroft-Walton accelerator; nuclear physics; cross-section measurement; Cold War

Science and Technology Heritage on Portuguese and Brazilian Museums: first results of a more thorough comparison

Marcus Granato, Museu de Astronomia e Ciências Afins

Victor Emmanuel Teixeira Mendes Abalada, Museu de Astronomia e Ciências Afins

Luiza Regina Soares Maldonado, Universidade Federal do Estado do Rio de Janeiro

The ignorance that still surrounds the topic of science and technology (S&T) heritage means much of this heritage is yet to be tracked down and many items that could be presented as such might have already been modernized or disposed. After a Brazilian survey that built a panorama of this heritage’s current state on the country, the same process is being undergone focusing Portuguese reality, so as to provide basis for a parallel. The partial results of this ongoing research are here presented, aiming to establish the first thorough comparison between the current state of S&T heritage on both countries, concentrating on heritage preserved on museums, since, up until now, information has been easier to retrieve and more complete on this kind of institution. The sets and collections of interest to the study are composed of objects related to the exact and earth sciences produced until the 1960s. With an older scientific tradition, objects that go back at least to the XIIIth century can be tracked down in Portugal, whereas, in Brazil, objects dating further back than the XIXth century are scanty. Nonetheless, on both cases most located objects derive from the XIXth and XXth centuries. This paper intends to present a deeper analysis of S&T heritage on both countries, on categories that range from its quantity to the level of preservation, thus providing better understanding of the role these objects played on the making of science and how they are now seen, appreciated and studied on these different realities.

Scientific instruments; Scientific heritage; Museums; Brazil; Portugal

The physics teaching instruments at the Bento de Abreu state school of Araquara (SP) Brazil: official recommendations (1931-1961), past and present

Maria Cristina de Senzi Zancul, São Paulo State University

Elton de Oliveira Barreto, São Paulo State University - UNESP

Among the 21 public secondary schools created by the State of São Paulo (Brazil) between 1930 and 1936, the Escola Estadual Bento de Abreu State de Araraquara (EEBA) is the one with the largest and best preserved set of ancient instruments for physics teaching. Considering that the trajectories of the objects can help us to understand important aspects of the

history of science education, in this paper we present the results of a study regarding the old instruments at EEBA, through which we sought to identify, from the instruments that are in the school today, those that were indicated for the teaching of Physics in the legislations in force between 1931 and 1961.

Using documentary analysis procedures, we examined the relations of didactic materials for the teaching of Physics that were supposed to be present in the schools for official recognition at that time. We also analyzed photographic images of the school physics laboratory, taken in the 1950s, in which instruments for physics teaching are shown.

We have identified that most of the older instruments present today in EEBA are listed in the text of the Teaching Reform from 1931, and several of them can be recognized in photographic records of the past.

school material culture; educational heritage; history of physics teaching

Linking past and future: Henrique Morize (1860-1930) and the National Observatory

Maria Lucia de Niemeyer Matheus Loureiro, Museu de Astronomia e Ciências Afins - Mast
Ana Beatriz Soares Cascardo, Museu de Astronomia e Ciências Afins

The administration of Henrique Morize in the National Observatory (Rio de Janeiro, Brazil) resulted in major and significant changes. During that period (1908-1929), the Observatory finally moved from the old building in Castelo Hill to the one it occupies today. Descriptions of the new facilities provide information about the existence of a museum where the first device models used in the Observatory would be on display. Morize headed the Observatory during the centenary of Brazilian Independence in 1922, and the centenary of the Observatory itself, in 1927. Morize wrote the history of the institution to celebrate this centenary. Despite delays caused by World War I, the Observatory equipment was modernized and expanded. This paper discusses the flow of instruments during his period, focusing on those purchased especially for the new facilities, those that were out of use due to lack of space in the old building and also historical instruments intentionally preserved. Some of these instruments survive today in the collections of the Museu de Astronomia e Ciências Afins (MAST).

Henrique Morize, National Observatory (Rio de Janeiro, Brazil), Museu de Astronomia e Ciências Afins

Early Forms of Telescopes, in Theory and in Practice

Marvin Bolt, Corning Museum of Glass
Michael Korey, Mathematisch-Physikalischer Salon, Dresden State Art Collections

Archive-based scholarship has revealed much about the emergence of the telescope in 1608, its dissemination, and its evolution. Investigation of actual instruments, however, provides an important and necessary source of information, and a check on speculation. Inspired and informed by the work of Rolf Riekher, Rolf Willach, M. Eugene Rudd, and Duane Jaecks, we have, over the past decade, located and identified over 1000 refracting telescopes made before 1750. Our recent discovery and investigation – in two German museums – of the only two known surviving early Keplerian telescopes (each having a positive objective and a positive ocular lens) provides material evidence relating to archival discussions and to previous interpretations of telescopic representations. We shall see, for example, how those representations range from a crude illustration merely suggesting a generic

telescope to one accurately depicting a specific instrument, with others in between whose significance remains to be investigated.

telescope; material culture; representation; Kepler

The machine that goes 'bing': nineteenth-century uses of telephone instruments in medicine, mining and the military

Michael Kay, University of Leeds

When Alexander Graham Bell demonstrated his new telephone instrument in Britain for the first time in 1877 he admitted that it was then in an “embryo state”: he did not know what form it ultimately might take, or the uses to which it might be put. Indeed, the journey of telephony from inception to ubiquity was not rapid or straightforward, and it was not immediately obvious what telephone instruments might be used for. This supposedly global technology – marketed early on as an invention for conversation which anyone could use with ease – had a wide variety of different local applications.

This paper focuses on the reception of telephone instruments, in particular Bell’s electromagnetic telephone, and the users who innovated with them in three areas: the medical profession, the mining community, and British Army. In each case this paper will demonstrate how the basic property of telephone instruments, that of producing noise upon the detection of small currents, was put to different uses – and not necessarily for transmission of speech.

The use of telephone instruments for non-conversational purposes such as scientific and medical research has not been much addressed by existing histories of telephony. However, the importance of users, as well as producers, in the development of technologies has been demonstrated by Oudshoorn and Pinch (2003), amongst others; this paper expands upon their approach by exploring how the uses of telephony in late Victorian Britain depended on, and reveal new insights into, the people and communities who engaged with these new instruments.

telephony; electricity; users; medicine

The Theatrum Astronomicum of the University of Leiden according to the 1637 astronomical records by Georg Marggrafe

Oscar Toshiaki Matsuura, MAST/MCTIC

In order to characterize the observational practice and the instrumentation of the Observatory at the time, and to estimate the instrumental and observational performance from the positional measurements and timing of the observations, 29 out of 119 Marggrafe’s documents stored in Erfgoed Leiden en Omstreken (ELO) were set apart for a detailed analysis. These documents record astronomical observations made between January 13 and November 6, 1637 at the Observatory of the University of Leiden, just before Marggrafe came to Brazil. The study began with the transcription and translation of the Latin manuscripts by Marggrafe’s own hand, and went through the statistical analysis of the observational data. The cross-referencing of the obtained results with subsidiary information highlighted the exceptional status of the Observatory at that time, its innovative structure within a reformist and innovative university, the mainstream astronomical themes and the peculiar trajectory of Marggrafe’s astronomical training, particularly in practical astronomy (instrumentation and observation) obtained as an autodidact in Leiden in only 14 months. For being part of the extraordinary development boom between the empirical and the kinematic

astronomy of Tycho Brahe and Kepler respectively, and the dynamic one of Newton, and considering the shortage of more detailed information about the observatories of the time, this study hopes to offer a small but meaningful contribution to the history of astronomical instrumentation of the first half of the 17th century, while also complementing an earlier work of the author with Huib Zuidervaart presented in SIC2012 on the Marggrafe's Observatory in Dutch Brazil.

"astronomical instruments"; "astronomical practice"; "Leiden Observatory"; "Georg Marggrafe"

Revamping the solar system: orreries, Copernican armillary spheres, and the idea of 'discovery' in the solar system

Pedro Raposo, Adler Planetarium

The 'solar system' has long been a changeable entity, be it due to the addition of newly found objects, or, as a consequence of the latter, the reclassification of previously known bodies. Orreries and Copernican armillary spheres had an important role in shaping public representations of the solar system. Their makers usually sought to convey the most up-to-date portrait of our planetary system. Moreover, older devices were often modified and expanded in the face of new additions to the roll of known planets, satellites and asteroids. This paper addresses the orrery and the Copernican armillary sphere with regard to the idea of 'discovery' as a narrative staple in the teaching and the popularization of astronomy, particularly during the nineteenth century. A case in point is a Copernican armillary sphere in the collections of the Adler Planetarium sporting a mysterious 'Taurus' as the farthest planet in the solar system. This seemingly bizarre feature will be analysed in order to highlight the connections between this kind of artifact, the nineteenth-century discourses of discovery in astronomy, and the exploration of new market niches for educational instruments and scientific toys.

Astronomy, solar system, orrery, Copernican armillary sphere

Scientific instruments as a tool for the transmission of knowledge: The case of a 15th century treatise on the operation of the Musartan astrolabe

Pouyan Shahidi Marnani, Department of Near Eastern Languages and Cultures/ Islamic Studies Program, Indiana University

In the 9th or 10th century CE scholars in the Islamic world made an innovation in astronomical instrumentation by combining the standard northern and southern astrolabes to create a class of astrolabes known to the modern literature as "mixed astrolabes". Musartan (=crab shaped) astrolabe is one of the more well-known astrolabes of this kind in the medieval Islamic world.

In addition to the standard, medieval literature of astrolabe-making which reveals the geometric-astronomical structure of the Musartan astrolabe, a group of treatises were written, specifically, on its operation. Mukhtasar dar ma'rifat-i usturlab-i Musartan wa Muqawwas (compendious [treatise] on the knowledge of the Musartan and the Muqawwas astrolabes) is a treatise of this kind, written in Persian by a certain Pir Muhammad, known as Hakim-i Tabrizi (14–15th century CE, Tabriz). This recently rediscovered text is chronologically the latest known text written on the use of the Musartan astrolabe. However, what makes this work distinct from its peer texts, that half a dozen of them are extant today, is the isolation of its author from them. This isolation is not only suggested by Tabrizi who claims to have discovered how to work with an instrument that was unknown in his time and place, but is also attested to by the contents of his treatise.

In the present research, based on my critical edition of Tabrizi's text, I first demonstrate the disconnection of Tabrizi from the literature of the Musartan astrolabe. To do so, I contrast the terminology that he uses to describe this astrolabe, the definitions that he provides for them, and his approach to the complications of the instrument's operation with what can be found in the preceding literature—especially the two earliest, extant works on this instrument by Abu Sa'id al-Sijzi (ca. 945–ca. 1020 CE). Moreover, based on Tabrizi's text as well as the other pieces of literature on the mixed astrolabes—especially the work of Abu Nasr Ahmad b. Zarir (12th century CE)—I investigate the possibility of existence of an oral tradition on the Musartan astrolabe as an auxiliary source for Tabrizi. I then show how in isolation from the textual tradition of the mixed astrolabes, Tabrizi succeeded in writing a “user's manual” for the Musartan astrolabe mainly by learning from a specimen of this very instrument in his possession. Tabrizi's then 450 year old Musartan astrolabe becomes the main vehicle for the transmission of this instrument's operation.

Knowledge transmission; Astrolabe; Musartan; Tabriz

Instruments of Development: German Teaching Apparatus and Practices at IIT Madras

Roland Wittje, Indian Institute of Technology Madras

The Indian Institute of Technology (IIT) Madras was founded in 1959 with the assistance of the Federal Republic of (West) Germany in the midst of the Cold War and an evolving development discourse. As part of the agreement, a number of German experts joined IIT Madras as professors for the initial years to set up laboratories and engineering curricula, and to supervise students and research scholars. A first generation of Indian faculty in return received their training in Germany. German ideas and practices of engineering education are manifested and have materialised in laboratory setups and large amounts of German scientific instruments. How did the German professors think Indian engineers should be trained? And how did these ideas and practices of engineering education transform in the Indian, or we might rather say in the Madras environment? While Indian IIT-graduates have become a successful brand within the international corporate world, the curriculum has gradually moved away from a focus on the laboratory, and towards computation and theory. In my presentation, I will trace the first generation of these German instruments at the physics department of IIT Madras and place them within the concepts and traditions of science and engineering education. I will discuss how these instruments were actually used and how practices changed in the decades after the foundation of IIT Madras.

Teaching Instruments, Cold War, IIT Madras

Discipline Building with Material Culture: Instruments and the History of Science in Later C20th Britain

Sam Alberti, National Museums Scotland

History and philosophy of science expanded significantly in 1960s Britain as it did elsewhere, concurrent with professional developments within the museum sector that changed the pattern of acquisition and display of instruments in science collections. Interrogating the relationship between these two mini-industries helps us to understand the role of material culture in the construction of expertise. Building on existing studies of the relationship between collections in Oxford, Cambridge and London earlier in the century and the history of science teaching programmes that followed them (Bennett

ICHST
2017

1997; Fox 2006; Morris 2010; Taub and Willmoth 2006), this paper explores connections between other collections and new centres for HPS elsewhere in Britain. Focussing on the instrument collection of the Royal Scottish Museum in Edinburgh (a predecessor of the National Museums Scotland), it asks how collections were used – or not – in teaching and research by new generations of historians and curators. What role did scientific instruments play in the development of history of science in an era of unprecedented higher education expansion? How was historical expertise manifested in exhibitions and displays? And how did developments within one locality (Edinburgh) reflect the global relationship between museums and universities? Fifty years after later, the Rio Congress will be a fitting place to reflect on these connections as the Scientific Instrument Symposium and the International Congress of History of Science and Technology meet together.

collections; history of science; Royal Scottish Museum; Edinburgh

Studying and exhibiting instruments of global infrastructures for environmental monitoring and surveillance

Sébastien Soubiran, JARDIN DES SCIENCES - UNIVERSITY OF STRASBOURG

Soraya Boudia, University of Paris Descartes-CERMES3

Scientific instruments studies often focus on the history of a specific instrument or a number of instruments that are part of an experimental setting. This objet-based approach produced precise and useful research on instrument makers, instruments' circulation and trade, different users and 'life cycles' from makers to users, and the related knowledge they generated.

If this approach is indeed heuristically very rich, its utility is less obvious to study global research infrastructures in charge of collecting environmental data beyond national scale. These infrastructures are characterized by both the use of a large number of instruments dispersed through distant locations, and different type of instruments to process the data. These infrastructures emerged in European observatories during the first half of the nineteenth century as a result of networks for geomagnetism and meteorological observations. New technical exploratory technics like seismometers, sonar and radar, expanded the capacity and range of observations on a worldwide scale. These observation and research networks spread during the second half of the twentieth century for technical and political reasons. On the one hand, technological developments, such as computers and satellites, gave access to data collecting and processing at a previously unknown scale. On the other hand, during the cold war, the entire Earth became a battlefield equipped with international measure systems of radioactivity or seismology used mainly for monitoring the Soviet enemy.

In this paper, we will first present a state of the art of research in history of science and technology on global scientific infrastructures for environmental monitoring and surveillance. Secondly, based on the renovation process of the zoological and seismological museum initiated in Strasbourg, we would like to explore how these studies can be used in a museum exhibition setting in order to address environmental issues and develop public engagement with science and research.

monitoring, global scientific infrastructures, exhibition, public engagement

Electromagnetic devices in early nineteenth-century Padua

Sofia Talas, University of Padua

Fanny Marcon, University of Padua

In the 1830s, Salvatore Dal Negro, professor of experimental physics at the University of Padua, developed a series of electromagnetic devices, such as the “dynamo-magnetometer”, an instrument meant to measure the force exerted by electromagnets, and the “electromagnetic ram”, a peculiar model of electrical motor. These instruments long lay disassembled in the storerooms of the Museum of the History of Physics of the University of Padua, and they have only recently been studied, restored and reassembled for the first time.

The present paper will describe these newly restored devices and contextualize them within the developments of electricity in the early nineteenth century.

history of electromagnetism; motors; restoration

The Role of Instruments in the Evolution of Timekeeping

Taha Yasin Arslan, Istanbul Medeniyet University

Timekeeping was an important knowledge (‘ilm) field for Muslims for centuries, because it dealt with the essential problems of Islamic life, such as finding the qibla (the direction of Mecca), determining the times of the five daily prayers, and correctly predicting the beginning of Ramadhan (the month for fasting) and two eids (religious holidays). In early Islam, timekeeping was initially a practice giving approximate solutions only based on naked-eye observations, without any instruments or calculations. After the reception of astronomy in the Islamic World in the 9th century, timekeeping found its place as a branch of astronomy. For more than a thousand years, Muslims continued the tradition of timekeeping from Transoxiana to Andalusia. However, some centres of knowledge were keener on improving timekeeping than others. Mamluk Egypt and Syria in the 13th-15th centuries, and Ottoman Turkey in 16th-20th centuries were epicentres of the development and evolution of timekeeping. Observational and computational instruments had the most obvious and effective role in this evolution. From a simple gnomon to sophisticated mechanical clocks, instruments gradually changed the approach to timekeeping. This presentation introduces the journey of timekeeping from its roots in Baghdad to its golden age in Mamluk Egypt and Syria, up to its maturity and adaptation to modern sciences in Ottoman Turkey within the context of instrumentation.

timekeeping; astronomical instruments; Mamluk astronomy; Ottoman astronomy; the history of astronomy in the Islamic World

Challenges and opportunities in the study of recent heritage of Science and Technology: Two examples of astronomical instrumentation

Tania P. Dominici, Museum of Astronomy and Related Sciences

The historical and documentary value of scientific objects of the end of nineteenth century and, in particular, those built from the twentieth century, began to be recognized only from the 1980s, in a process that is still seeking its consolidation and methodological adequacy. In this work, I discuss through two examples the complexity in the recognition, registration and protection of these objects. The first instrument is JET-X, the X-ray space telescope that has never been in orbit, whose

construction was led by the UK and today held by the Science Museum in London. The second is the integral field spectrograph Eucalyptus, built in Brazil as a prototype for a larger instrument, the SOAR Integral Field Unit Spectrograph (SIFS). Eucalyptus is now part of the collection of objects with historical value of the Brazilian National Laboratory of Astrophysics (LNA). That collection was identified from a partnership with the Museum of Astronomy and Related Sciences (MAST). Besides demonstrating the complexity of the identification, preservation and research of the recent heritage of S&T, I argue that the analysis of problems and challenges faced in the development of astronomical instrumentation in recent decades, especially through research on the material heritage of projects that have not been fully successful, can help guide the scientific community in decisions on new investments and in the management of the design and construction of future instruments. Finally, I highlight the importance of providing public access to these objects.

recent heritage, astronomy, documentation, material culture

Did the presence of the scientific instruments affect the destiny and workload of the liberated Africans? Science and freedom: new evidence about foreign engineers in nineteenth-century Brazil – Minas Gerais

Télio Cravo, UNICAMP

Liberated Africans, Slaves, and free coloured people worked on heavy manual activities during the construction of road and bridges in nineteenth-century Brazil. This presence produced direct effects in the organization of laborers and the behavior of province engineers. In the 1850s, foreign engineers working in Minas Gerais province requested scientific instruments from Viena and Paris. After that, the engineers also requested the Brazilian government to provide with liberated Africans to work on the transport and dismantling of scientific instruments. The results demonstrate that province engineers intervened in the destiny of liberated Africans. During the decades known as the “illegal slave trade era”, liberated Africans formed a special legal category present in Brazil, Cuba, and the British Caribbean. The literature has focused on the implementation of mixed commissions and the fine line between slavery and freedom in the nineteenth-century Atlantic world. In Brazilian historiography, recent work also suggested that liberated Africans were assigned to the building and maintaining road infrastructure. This paper presents preliminary results of ongoing research to demonstrate how different juridic conditions lead to an explicitly unequal treatment. Main sources used were documents related to the construction of road infrastructure, collected and treated in a database that comprises 22,000 documents for the period of 1840-1889. Moreover, this research has also explored the registration of liberated Africans. The registration offers valuable information. Documents contain name, age, nação (nation), place of employment and the name of responsible (e.g. engineers, private individual, Jardim botânico). These records are important for the study of the illegal servitude and show that legally binding labor contracts were imposed without the consent of the Africans involved.

Liberated Africans, Juridic Condition, Engineers, Scientific Instruments

Dissemination and influence of the Zeiss optical planetarium in the republic of China (1923-1949)

Zhang Nan, School of History & Culture of Science, SJTU

The Zeiss optical planetarium was born in 1923 in Germany. Within the Popularization of Science Movement of China and the first worldwide boom of planetariums, the concept and image of the Zeiss planetarium was introduced into China. Through a study of Chinese popular texts in this period, the author will examine the process of disseminating popular astronomical knowledge and will seek to explain why China did not construct a planetarium until the 1950s. The paper will also offer some more general ideas on the function and orientation of the planetarium.

Zeiss Planetarium; the artificial sky; the Republic of China

048. Historical inquiry & intellectual transmission: How shall we write about how knowledge travels?

How does knowledge travel? Theoretical considerations and two case studies in the history physics in Japan

Kenji Ito, SOKENDAI

In the recent historiography, the transmission of knowledge can be considered as a process as complex and possibly as important as the production of knowledge. When knowledge changes its location, it has various causes and consequences. It involves both human agency and material conditions. Knowledge can be both embodied or disembodied and tacit and explicit. Identity of knowledge can always be contested in this process. Knowledge spreads, diffuses, cascades, circulates and resonates. This paper discusses these theoretical issues related to the transmission of knowledge. Then I illustrates some of theoretical issues in two cases with different scales. One is the transmission of quantum physics into Japan. The other is the transmission of the Feynman diagrams into Japan.

Transmission of knowledge; history of physics; history of science in Japan; history of science in Asia; History of quantum physics

On the Arabic Origins of Algebra: Historiography Beyond the Academy

Madeline Muntersbjorn, University of Toledo

In the 1970s an infamous dispute arose among historians of mathematics as to whether the Ancient Greeks had algebra. Those who affirmed the Greeks had algebra did not suggest modern algebra was explicit in Euclid. Instead, they argued that specific parts of Euclid only made sense when algebraic insights contained therein were recovered by historians equipped with modern symbolism. Those who denied the Greeks had algebra insisted that any Ancient Greek algebra was not discovered so much as created by historians who relied too heavily upon anachronistic notation. Since then, the dust from this dispute has refused to settle as what it means to say that an individual, community, or culture “has” a particular kind of mathematical knowledge continues to prove elusive. In addition, what was once an academic debate has spilled into the blogosphere as pundits now propose that, despite its name, algebra did not originate in what we call the Middle East but, like all good ideas

anyone has ever had, algebra originated in Europe. Indeed, both the past and future of algebra hangs in the balance as some scholars in the US propose eliminating algebra from the curriculum as the single most expedient way to increase graduation rates since algebra is the course failed most often by too many students who, in all probability, do not even need it (e.g., Hacker 2016). What was once a local dispute amongst academic specialists is now part of a more global inquiry into how knowledge is transmitted from one part of the world to another, what mathematics should be taught to the next generation, and why we care about the origin stories we tell about past mathematical practices. Conducting this inquiry requires that we consider the distinction Unguru (2004) makes between approaching the past through the mathematical door versus the historical door. While this distinction is useful, I do not think "mathematical and historical approaches are mutually antagonistic and that no compromise is possible between" these two approaches (383). However, it would be naïve to think the historiographical issues these transmission narratives raise are of purely academic interest, where experts may agree to disagree from the comfort of their scholarly aeries. For how historians of mathematics talk about past mathematical practices shapes not only the public perception of mathematics but also what kinds of mathematics different parts of the public are able to perceive and acquire for their own use.

Algebra; Historiography; Mathematical Practice

Shaping transmission in 19th century cultural history of mathematics

Martina R. Schneider, Mainz University

In the middle of the 19th century Moritz Cantor suggested to use the history of mathematics in order to study the cultural history of mankind. In his conception the transmission of mathematical concepts and practices played a key role in studying exchanges between different peoples, especially with regard to ancient times.

The talk will address the following questions: What forms of transmission did Cantor mention in this respect? How did he describe them? On what kinds of evidence did his argument rest? How did he construct "local" practices? Did he talk about "global" mathematics, and if so how? How did his humanist Herderian conception of one mankind divided into different peoples relate to his understanding of mathematics as a local (and/or universal) activity?

cultural history of mathematics; transmission; 19th century historiography of mathematics; Moritz Cantor

Historiography of the circulations of mathematical ideas: the case of the "Kerala School"

Agathe Keller, CNRS

Sho Hirose, Swiss Federal Institute of Technology in Zurich (ETHZ)

In this paper, we would like to reflect on the shifting historiography of circulations of the results of the "Kerala School". Our study will describe the historical formation of this idea of "Kerala School" in nationalist historiographies, from those ascertaining that its results were arrived at independently from a European influence, to the idea that its achievements could have travelled to Europe through Jesuit missionaries. However another history of circulations is possible, that of the possible influence of islamicate mathematics and astronomy on the authors identified with this school.

049. Teaching Science and its History in a Globalized World

'Modes of rationality' in the history of science for science education

Agustín Adúriz-Bravo, Universidad de Buenos Aires

I explore 'modes of rationality' in science education; I focus on the ways of discovery and justification of ideas, emphasising their educational value. I recognise two main modes of rationality –'logical' and 'narrative'– in stories based on the history of science. Those modes appear separated or reconciled according to the historiographical approach of the stories.

I understand 'mode of rationality' as the set of scientific inferences and arguments valid in a place and time in history. I find relevant the well-known proposal of 'styles of scientific reasoning' by Crombie and Hacking. I study the main modes of rationality following Bruner, Gardner, Fisher and Izquierdo-Aymerich, linking their ideas to the construction of 'science stories' for teaching. According to Bruner, we organise our experience under narrative form, which differs from the constructions generated by logical procedures traditionally identified with scientific thinking from a positivistic viewpoint. On these constructions the values 'true' and 'false' can be applied, while of narratives we can only predicate 'verisimilitude'.

I associate the 'logical mode' to the stabilisation of the syntactic structure of science, relating it to the concatenation of knowledge in the form of nomothetic or formal propositions through deductive reasoning. I link the 'narrative mode' to the historical development and construction processes of science, relating it to 'argumentative' aspects of science, in the 'context of discovery'.

In order to explicate the nature and dynamics of rationalities, Izquierdo-Aymerich maps them to two distinct phases of detective fiction: logical rationality corresponds to the classic period, exemplified by Conan Doyle, and narrative rationality maps to contemporary novels (e.g. Mankell or Camilleri). I propose a third mode of 'evidential' rationality welding traits of the other two; I link it to Agatha Christie. Evidential rationality would be defined by its goal of inference to the best explanation, understanding 'best' for a given state of affairs that is problematic and from a certain knowledge base that is accepted. These features are shared by scientific, detective, police, medical and forensic thinking.

What place can be given to evidential rationality in the production of science stories that science teachers can use in their classes? In the paper, I make some considerations on this issue using as context Rutherford's proposal of the 'planetary model' for the atom.

Rationality; modes; evidence; abduction; science stories

Is there a "good or bad" History of Science to Science teaching? A case study based on Arabic Medieval Science

Ana Paula Bispo da Silva, State University of Paraíba

Winston Gomes Schmiedecke, Federal Institute of Education, Science and Technology of São Paulo

In the last decades, History of Science (HS) has been trying to approximate itself to Science teaching through different perspectives. For the last years, a number of works that consider HS as a fruitful example to discuss aspects of Nature of Science (NOS) has increased, following some international standards as McComas (2008). In Brazil, this is expressed by the research of a group of Historians and Philosophers of Science and Science Educators which argue that HS, when written following rigid and restricted patterns – an appropriate HS, can teach students and future teachers about some aspects

of NOS. Otherwise, if the HS does not follow a restricted pattern – a bad HS, it can bring distorted views of Science, NOS and, then, affect the learning of Science and its features. However, despite the many efforts to produce materials to introduce the appropriate HS, the subject is not approached in Science classes. In this work, we argue that the resistance of teachers to use HS can be related to two points: i) from teachers' perspective, appropriate HS is not ideal to Science classes, and ii) HS is important by itself, without any explicit discussion about NOS. To reach answers to our hypothesis, we developed an empirical research in an undergraduate Physics teaching course. We developed the survey during the lectures of History of Physics (HP) of two groups of students, which totalized 26 students. The research had five lectures that deal with the role of History of Physics in Science Education and a historical episode on Arabic Science. At the end of the last lecture, students had to answer the following questions: From these three materials (chapter, article and video), which one would you use in a Science class in high school? Why? What would you highlight in the historical episode? Their answers were analyzed reaching similar results. The research showed that the important aspects of NOS for Science teachers are not directly related to the kind of HS used. For these future teachers, the main role of HS in Science teaching is to motivated students to know about Science. From this point of view, the efforts of Science Historians, Philosophers and Educators must be turned to make a HS able to be understood. An attractive HS seems to be more plausible to approach in Science classes than one that is too worried about NOS.

History of Physics; Arabic Science; Teachers training

Could History of Science improve discussions of scientific practices in science teaching?

Andreia Guerra de Moraes, CEFET/RJ

Andreia Guerra, CEFET/RJ

Cristiano Moura, CEFET/RJ

Tânia Camel, FIOCRUZ

Many science education studies have indicated that it is important to introduce in science classes discussions about science. In this way, educational policy documents in different countries and studies in science teaching have argued that the inclusion of scientific practices in science education could brought important considerations for teaching about science. However, it is important to consider the different possibilities concerning through this emphasis. One possibility, that we consider in this study, is that which advocates the importance to develop pedagogical practices in which the dynamic character of science is highlighted. This approach could bring interesting perspectives for discussions about science, because it could indicate paths that avoid essentialist characterizations for scientific knowledge and paths that improve understanding about science, considering the complexity of it.

However, to consider scientific practices in science teaching, it is necessary to face challenges in historical approaches. In order to contribute to the debate around the theme, this study aims to construct subsidies to develop pedagogical practices in a historical approach, focusing on the study of historical development of organic chemistry in the 19th century, in which scientific practices is fundamental element to discuss science.

In this study, we argue that it is necessary to consider epistemic issues together with sociocultural issues when discussing scientific practices in science education. Scientific practices are not restricted to abilities for manipulate instruments and for read data and graphics, it is necessary to associate these performances with cultural and socio institutional issues capable of producing valid meanings for scientific community. This association has a historical dimension, once the culture, the institutions and their roles change over the time and space where they were constructed. To achieve this goal, we will discuss how the development of organic chemistry in 19th century reveals issues about scientific practices and of its mutable characteristics, improving discussions

ICHST
2017

about scientific practices. The historiography called Cultural History of Science, exemplified with the establishment of synthetic carbon chemistry, could be a path to discuss scientific practices in science teaching, associating these performance with cultural and socio institutional issues capable of producing valid meanings for scientific community.

"Scientific practices"; "culture"; "science teaching"

Astroparticle physics: from the local to the global and back to the local

Cibelle Celestino Silva, Institute of Physics of Sao Carlos, University of São Paulo

This paper presents results of a dissemination project conducted in Brazil about astroparticle physics that combines the creation of an itinerant exhibition about history of physics with teaching contents about astroparticle physics. The exhibit allows the discussion of modern physics concepts, invites visitors to reflect about science in a globalized world, the importance of hundreds of female microscopists in the analysis of the plates, the structuration of Brazilian physics, the contribution of Brazilian scientists to the study of cosmic rays and astroparticle physics and the raising of the "Big Science".

In the 1930's, science was part of a Brazilian nation-wide project, supported by scientists, nationalistic intellectuals, artists, industrialists and rich farmers. The study of cosmic rays is a key step in the development of physics in Brazil. It was fostered by the invitation of foreign physicists to the University of Sao Paulo (USP), founded in 1934. One of the most famous Brazilian physicists is Cesar Lattes who graduated at USP in 1943 and studied cosmic rays with a cloud chamber.

At the end of 1945, he received from one of his professors a new type of detector: nuclear emulsion plates. Very enthusiastic about the results, Lattes moved to Bristol in 1946 to work in the group of Cecil Powell. The Brazilian asked the manufacturer of nuclear emulsions to include boron in some plates, having in mind that this increment would allow the indirect observation of neutrons created by the shock of cosmic radiation with atmospheric atomic nuclei. In May 1947, Lattes exposed the plates in the Mount Chacaltaya (Bolivia) at 5,200 meters. Lattes returned to Bristol where the team of physicists and women microscopists found with these plates the more than 30 mesons events. The finding provided worldwide fame to the Bristol laboratory – and a Nobel to Powell in 1950.

In 1948 Lattes moved to Berkeley, where with Eugene Gardner produced artificial mesons in a synchrocyclotron accelerator. Lattes and Gardner's important achievements were strategically used by Ernest Lawrence to raise funds to build a much more potent collider, the Bevatron, in which the antiproton would be discovered in the mid-1950s. In Brazil, Lattes' deeds contributed to a campaign to fund the creation of the Brazilian Center for Physical Research by José Leite Lopes in 1949 and to the payment of full professorships for researchers in Brazil.

History of Brazilian physics; Cesar Lattes; Astroparticle physics

Teaching Chemistry in the Deutsches Museum: Between the alchemist's dungeon and high-tech chemistry

Susanne Rehn-Taube, Deutsches Museum

The museum as an educational institution has a very long tradition. This applies especially to science and technology museums. The connection of basic principles and technical applications leads directly to the representation of special professions and has a meaningful effect on the main target audience of young adults. In the Deutsches Museum in Munich we understand ourselves as an educational institution with a global influence that traditionally affects the choice of profession in young people.

At 50,000 square meters, we show masterpieces from many diverse disciplines, one of which is chemistry. The chemistry galleries always focused on the chemical laboratory as a place where chemistry took place and where famous chemists worked. Therefore replicas of historical laboratories from the alchemist's times through the 18th and 19th centuries were shown. The previous exhibition of scientific chemistry (1972 – 2009) won some popularity for its very sophisticated concept. The shown topics were chosen from chemical principles and were presented using push-button experiments. The lack of connection to your daily life made it hard for many visitors to really understand the chemistry shown. The future exhibition will take a different route. The basic message is that chemical products and chemical principles are experienced by everybody, every day. Using a wide variety of modern exhibits, topics such as nutrition, cosmetics or modern high-tech chemicals will be shown. When it comes to raw materials we may see how the entire chemical industry will re-center itself: away from crude oil as the main raw material towards a more local search for renewable resources for the 21st century. Together with modern state-of-the-art chemistry many examples of scientific history will be presented. We open the discussion about how developments in science and technology are connected with changings in the society. One example of this is the discovery of nuclear fission: The beginnings of one of the most impressive (and controversial!) technical developments of the 20th century are illustrated by the original equipment with which the discovery was made. In this way, we will contribute to the educational mission of the coming generation in a globalized world. The paper presents the concepts for the redesign of the exhibition and our approach to this education.

Teach; Chemistry; Deutsches Museum

Acting on Curiosity, Voicing Questions: in developing as investigators, Learners break new ground in understanding science, history and ourselves

Elizabeth Cavicchi, MIT Edgerton Center

With global interrelations an everyday matter, diversity in who we are abrades with homogeneity in what we are expected to know and be. Alternative to the homogeneity of much formalized science and education, with its limited accessibility, is the outlook that vibrant understanding of the world /develops /through diversity and interaction among our experiences and questioning. Where diverse experience is the agency by which science develops, a crucial, yet seldom enacted, role for education lies in providing open environments where learners engage in, and reflect on, their diverse experiences. In attesting to the uncertainty inherent in science as it develops, history offers colleagues to learners who are pioneering their own diverse experiences. This study documents learners in my university classroom, as they explore in the open environment created through their own diversity.

Diverse perspectives emerged when I asked students to interview someone for memories about boxer Muhammad Ali and astronaut John Glenn. One student risked admitting: "I am Chinese, I didn't hear about these two before." Her honesty made others feel safe to share. A Korean father said of Glenn "I know him, he's a singer"; a US teacher recalled the Muslim commitment of Ali's opposition to the Vietnam War. This diversity deepened the class' dialogue.

Historical experiments furthered awareness of diversity. The glass armonica, a musical instrument invented by Benjamin Franklin, provided historical context for students in sounding wine glasses. Responding to Franklin's printing, students collaboratively set the text of poems in lead type, letter by letter, backwards! Reading about Benjamin Banneker, African American surveyor, students used historical surveyor's tools in museums. On redoing Banneker's work, one student reflected: "What a point in history: to believe our stations in life were mutable, that we could achieve whatever we wished through hard work."

The act of handling materials possessing historical depth, while pursuing personal investigations, was irreplaceable and transformative for these students. Through actions they initiated, students came to

questions not otherwise available to them, such as the effects of water on the sound of glass. Through actions they initiated through curiosity, students came to questions not otherwise available. They inferred physical science relationships, found affinity with history, and became empowered as explorers.

exploration; active learning; history; balance; geometry

Modeling Newton's Lunar Precession Problem and its Role in Understanding "Scientific" Method

Pierre Boulos, University of Windsor

During the Enlightenment, Newton's theory of gravitation was empirically challenged in basically three important ways: geodesy, perturbation theory, and the return of Halley's comet. The biggest challenge to Newton and his theory was the lunar perturbation problem. Newton claimed that calculating the lunar motion was the only problem that ever made his head ache. He knew why too: It was because the moon is attracted strongly by two bodies—the earth and the sun, pulling at different angles to one another—whereas the planets are attracted strongly only by the sun. According to Westfall, the "lunar problem," from Newton's day to the present, has been cast as the "linchpin of the entire argument for universal gravitation." This paper will offer a brief reconstruction, using modern mathematical and computational tools, of the lunar precession problem and show how using these tools can aid us in understanding the nature of this problem and its solution.

In this paper we will consider Leonard Euler's "oeuvres" in astronomy. Although he is particularly and usually noted for his work in mathematics, pure and applied, our focus will be on his success in astronomy and most notably in celestial mechanics. The approach taken in this historical sketch will be to progress chronologically instead of imposing a particular structure on Euler's development. That is, we will note a handful of "plots" which unfolded over his lifetime. These plots interweave and to delineate them would render this sketch longer and more repetitive than need be. We will add, in this sketch, glimpses of the other "actors" who share the various stages on which Euler's script is drawn out. These actors are not mere bit players but, rather, full participants in the history of astronomy and are each worthy of a similar sketch.

Newton; Euler; lunar precession; n-body problem

051. Transnational Knowledge during the Cold War: The Case of the Life and Medical Sciences

Karyotyping and Genetic Counseling in Mexico in the 1960s

Ana Barahona, National Autonomous University of Mexico

WWII not only affected the geopolitical landscape of the world, but also science and technology, particularly research in the life sciences and medicine. New studies in human genetics were being conducted in North America and certain European clinical settings in the early 1960s, when health care professionals and medical doctors were drawn to cytogenetics in the wake of the chromosomal explanation of many diseases and when human genetics underwent a sea change following WWII. In Mexico, the first studies on chromosomes were performed by Mexican pediatrician Salvador Armendares and his colleagues at the first Unit for Research in Human Genetics (UIGH) of the Mexican Institute of Social Security created in 1966. Their work was based on the study on congenital

malformations performed by the WHO that Mexico had participated in along with other fifteen countries. This study was carried out by Alan C. Stevenson, one of the earliest medical geneticists in the United Kingdom, with whom Armendarés decided to study at Oxford in 1963. New technologies like karyotyping were being standardized and implemented at the UIGH, paving the way for genetic counseling to be performed. Human geneticists developed precise diagnostic protocols to provide accurate genetic information to the parents of the patients for the development of future treatments and prophylaxis (preventive medicine). Neonatal testing through karyotyping was no one-way traffic from the laboratory to the clinic: karyotyping was produced in a feedback loop of theory, laboratory techniques, human suffering and historical contingency.

In his 1968 book *Citogenética Humana* (Human Cytogenetics), Armendarés included a chapter on genetic counseling as being “the most important practical application of human genetics knowledge,” quoting the 1964 WHO technical report on human genetics and public health. Karyotyping was a central practice in the early days of human genetics in the country “to start a rudimentary form of genetic counseling emerged in response to an increasing demand for genetic risk information and risk calculations” (Björkman 2015). The community of scientists described in this work demonstrates the importance in the clinic of new medical genetics practices learned abroad. This case also reveals how important the circulation of knowledge was in the formation of Mexican scientific elites, as well as demonstrating the national and transnational concerns that shaped local practices.

Genetic Counselling in Mexico; Salvador Armendarés; Human Genetics; Karyotyping; Cytogenetics

The Rockefeller Foundation and the training of high-ranking officials for public health in Brazil (1917-1951): research notes

Ana Paula Korndörfer, Universidade do Vale do Rio dos Sinos

Between 1917 and 1951, 88 researchers and professionals linked to Brazilian government institutions and/or departments received 92 fellowships from the International Health Division (IHD) of the Rockefeller Foundation (RF) to conduct studies in Brazil and abroad, in the areas of public health, nursing, medicine and biological sciences. Through the granting of fellowships, the American philanthropic institution aimed at training men and women to work in strategic positions in official health agencies or as directors and/or teachers in schools of hygiene, public health and nursing. By holding senior positions in government institutions and/or departments in their home countries, fellowship holders could determine institutional orientations and priorities, reflecting some of the ideas and practices which they had become familiar with during the period of study.

The project “Philanthropy and International Scientific Cooperation: the Rockefeller Foundation and the Training of High-ranking Officials for Public Health in Brazil (1917-1951)”, still under development, aims to analyze the Rockefeller Foundation's work in training public health personnel, in the first decades of the twentieth century, mainly through the distribution of fellowships, through which the American institution sought to disseminate ideas and models, and its relation to the development of public health institutions and policies in Brazil. Through a prosopographic study that focuses on the 88 Brazilian scholarship holders of the International Health Division (IHD) of the Rockefeller Foundation, between 1917 and 1951, it is possible to discuss, among other aspects, the process of selection of these fellowship holders by the Foundation, their profile, the training they received through fellowships, as well as their professional trajectory, taking into account the objectives of the fellowships mentioned above. In this communication, we will present some data on the profile of the fellowship holders and the training they received through fellowships.

Rockefeller Foundation; Brazil; public health; fellowship program

Travelling knowledge between Italian and Spain during Franco's regime: the construction of radioactivity counters

Ana Romero de Pablos, Consejo Superior de Investigaciones Científicas

Priorities for the emerging nuclear policy of Franco's government by 1950s were both training and research and the management of laboratories. Hidden behind these priorities, and this is one of the key points of my proposal, was the interest of constructing a network of political and military alliances that would place Spain on the international relations map. And the radioactivity counters, I suggest, were active agents in that process.

In exchange for 214 kg of uranium, the payment agreed in 1948 between the Spanish and the Italian states, three young Spanish researchers visited the Institute of Nuclear Physics of the University in Rome and to the Centre di Informazioni Studi di Esperienze (CISE) in Milan. Those centers were the model for the institutionalization of nuclear development in Spain, which began in 1948 with the company "Estudios y Patentes de Aleaciones Especiales" (Studies and Patents for Special Alloys, EPALE in its Spanish acronym), and culminated in 1951 with the Junta de Energía Nuclear (Board of Nuclear Energy, JEN in its Spanish acronym). The objective was to study techniques for constructing radioactivity counters. Techniques and devices, as well as ways of organization and institutionalization nuclear development, travelled along with the counters. Back to Spain, and following what has been learned in Italy, they began to construct portable gamma ray counters. But they soon abandoned the initiative upon learning of the existence of other North American detectors that were lighter and easier to use.

I will show the work developed with this instruments as part of a wide network of key political and military institutions that contributed to the origin of Spanish nuclear policy during Franco dictatorship.

"radioactivity counters"; "nuclear power"; "nuclear policy"; "Franco dictatorship"; "Spain"

US-Soviet Disputes as Cultural Antecedents of the Cold War's Transnational Science: Health as Power in "The World of Tomorrow" (1936-1940)

Leticia Galluzzi Bizzo, UFRJ

By formulating recommendations and rules, international organizations (IOs) create new categories of actors, new shared international tasks, and novel cultural models of governance and social innovation. The discourse within the IOs is historically contingent. The ways of knowing the world are linked to how people seek to organize and control it.

The right to food was central to the creation of the UN in 1945. IOs (especially the FAO) were instrumental during the Cold War in boosting the freedom from hungry as part of the efforts to construct a 'new world order' mentality, including strategic tactics such as technical assistance and the choice of singular themes from the nutritional science palette. Food as a commodity vs food as a moral good, agricultural and nutritional issues, related science and technology, universal equity, international interdependence, and global cooperation, were key themes.

Provoked by political and historical-epistemological ambiguities, instabilities, contradictions, disputes and hidden agendas, this nascent new internationalism was a kaleidoscope of asymmetries and fragmentary democratic trends, although put key moral questions in the front door of the UN.

Paradoxically, former colonial scientists were among the actors creating such nexuses and "new necessities", boosting the realm of the post-war food diplomacy. This occurred mainly by framing foods as promises, concepts, and beliefs, trying to define social reality by translating the right to food into a political act embedded in the ideological influence of the United States in the IOs, synchronically with the relative success of the Soviet agriculture.

Political action may create public space. The sedimentation of the human rights in the UN, and of the

right to foods in particular, was strongly intersected with the Cold War game - encompassing UN recommendations, local-international interrelationships, the nature of the nation-states, decolonization, an unique geopolitical dynamics among poverty/capitalism/socialism, and the relationships between science and society. It is also central to expose and ponder the relational role of the right to foods in comparison with other human rights, in times of stabilization of both the UN and of the international turning point in the core of the ideas of regulations on mankind's welfare.

Fairs; Internationalism; Transnational history; International Organizations; Transnational history of sciences

Modeling Nature, Modeling Society: Drosophila Genetics in Post World War Two Brazil

Tito Carvalho, UCSD / Harvard

As the field of STS focused on biological knowledge, animal modeling became a key site of analysis. Scholars have paid attention to the methodologies and types of reasoning used to develop animal models, as well as the ways in which these models ground cohesive scientific communities through shared understandings of fundamental concepts, techniques, and moral economies. *Drosophila*, modern biology's first model, has received particular attention in the literature, with Robert Kohler's book, *Lords of the Fly*, being a seminal reference. Divided into two parts, this book examines the construction and expansion of the *Drosophila* model in Mendelian genetics (*D. melanogaster*) and Darwinian evolution (*D. pseudoobscura*). Kohler adopts a pragmatic conception of credibility and truth that, according to him, locates the causes of scientists' behaviors and beliefs "in the production process rather than in professional and political ideologies." In this sense, Kohler's book has not only been informative for but also representative of the broader STS literature on model organisms. But while this work has been an invaluable resource for our understanding of model organisms as technological artifacts that are constructed within complex social and material systems, exclusion of politics limits the scope and command of its account. For example, questions about eugenics—which is to say, questions about the proper constitution of the polity of modern societies—are ephemeral to the work, something that is surprising given the immediacy of these questions for evolutionary genetics in particular and science in general. I argue in this paper that *Drosophila* evolutionary genetics was a site of the articulation of democratic values in the aftermath of World War Two. To do so, I pay special attention to the tropical species *D. willistoni* that Theodosius Dobzhansky studied in Brazil from 1943 to 1956 in regards to the adaptive value of genetic variation vis-à-vis variation in the environment. Based on Dobzhansky's unpublished correspondence, articles with Brazilian co-authors, and an original chapter on "adaptive polymorphisms" in the third edition of *Genetics and the Origin of Species*, I maintain that *Drosophila* at once modeled the genetic basis of evolutionary change as well as the ideal demos of liberal, cosmopolitan democracies.

Population genetics; race; democracy; coproduction

Biomedical knowledge in Mexico during the cold war and its impact in pictorial representations of Homo sapiens and racial hierarchies

Torrens, Erica, National University of Mexico

During the 1990s occurred a change in the studies of science and technology known as the 'pictorial turn' (Mitchell 1994). This change implied a renewed interest in the study of scientific representation

to show not only its relevance in the construction of scientific knowledge, but also in its validation process, dissemination and teaching. This growing interest in the visual side of science generated a series of theoretical and methodological precepts which offered new ways of thinking and writing about the history of science. Today, for example, the division between "form" and "content" or "idea" and "support" in the production of scientific knowledge has become difficult to hold. Some of these new narratives have shed light not only into science but other human activities, and importantly, the strong role of visual scientific representations as power and ideology vehicles. This paper aims to offer an overview of both, the state of Mexican genetics and biomedical knowledge during the second half of twentieth century and its impact in the visual representation of human groups and racial hierarchies. In general, "Discourse on racial hierarchy has been supported by illustrations" (Guédon 2014) which are normally reconstructions of European and North American origin. However, as scientific conceptions of race and human evolution have wandered in space and time since a while ago (seventeenth century the former and late nineteenth century the latter), and since "human genetics developed new techniques and practices after World War-II" (Barahona 2016) it is of interest to research into the local visual responses to evolution, Darwinism, eugenics and genetics by Mexican scientists and educators in the Cold War period.

This post-war time represents the beginning of the effort to delimit the existence of the Mexican mestizo due to the apparent possibility to characterize it genetically. How did these practices move towards the realms of pictorial representation of human diversity? Is it possible to say that post-war human genetics gave rise to a novel visual culture of human taxonomy?

Pictorial representation; human diversity; genetics

Assembling a police laboratory: genetics, databases and reconfigurations of Brazilian forensic expertise

Vitor Simonis Richter, Federal University of Rio Grande do Sul

Since the second half of 1990's, the field of forensic sciences has been energized by the emergence of DNA databases and its promise of a "next generation" of technologies that combine the precision of genetic science and efficiency of databases to better identify suspects. Brazil has recently joined the group of countries that has a national DNA database for criminal investigations. Brazil's network of DNA databases was created after the FBI donated its Combined DNA Index System (CODIS) in 2009 and a law regulating its use was approved in 2012. With more than 20 databases connected, it became the largest DNA database network outside the United States. Although DNA database's software and law, two crucial elements in the stabilization of this technology, are present in the Brazilian techno-legal scenery just recently, Brazilian forensic experts has been engaged in the process of introducing forensic genetics in the country since the end of 1990's. In this paper, I'll draw from interviews conducted with forensic geneticists in Rio de Janeiro's police genetic laboratory and university genetic scientists to describe the associations, challenges and the point of view of those involved in the process that led to the emergence of Rio de Janeiro's police genetic laboratory. This account helps us question the different sociotechnical elements that are drawn together in order to assemble a police genetic laboratory infrastructure in Brazil. It also helps us perceive shifts in the configuration of forensic experts working within Brazilian police and their professional identities and subjectivities constructed in the frontier of police and scientific work.

DNA databases; forensic genetics; forensic laboratory; Brazil

052. Social Movements and the Right to Health Care

U.S. Immigrant Activism for Access to Health Care

Beatrix Hoffman, Northern Illinois University

In the United States, the 2009 Affordable Care Act has expanded health insurance coverage to nearly 20 million people. However, undocumented immigrants are excluded from participating. The 11 million undocumented residents of the U.S. constitute a large proportion of the uninsured population. This paper examines the history of U.S. approaches to health care for immigrants and migrants, which at times has provided some types of limited access alongside exclusionary policies and practices. It will analyze the role of immigrant and migrant action and activism in challenging health care exclusion.

The paper focuses on two major episodes in the history of immigrant/migrant health activism: the United Farm Workers (UFW) movement in the 1960s, and the immigrant rights movement that organized against California's Proposition 187 in the 1990s. The UFW is most remembered for its successful grape boycott starting in 1965 that led to widespread recognition of labor unions in California's agricultural fields. At the height of its influence, UFW leaders decided to set up health clinics at several locations in California that would provide health services to union members and also serve as an organizing tool among workers whose health had been neglected for generations. The UFW in Arizona followed a similar strategy but, in defiance of national leader Cesar Chavez, opened their union and their health clinics to undocumented workers.

The struggle in the UFW over the rights of the undocumented presaged a nationwide immigration debate that erupted in the 1980s and '90s, when undocumented immigration increased dramatically. California's anti-immigrant law Proposition 187, passed by referendum in 1994, attempted to end all non-emergency health services for undocumented immigrants in that state. In response, immigrants and their supporters launched a protest movement that insisted on health care access as a human right, regardless of citizenship. Although Proposition 187 was eventually overturned in the courts, other states including Arizona and Alabama have subsequently attempted to curtail undocumented immigrants' right to social services. The paper will conclude by discussing the present-day immigrant rights movement and its response to these state efforts, as well as to the exclusion of the undocumented from the Affordable Care Act.

social movements; immigration and migration; health care access; United States; farm workers

Social movements' challenge to the role of private insurance companies in Colombia's 1990s health reforms

Diana Goretty Oviedo Manrique, Universidad Nacional de Colombia

The various strategies implemented by multilateral agencies to overcome the "lost decade" of Latin America in the late 1970s and early 1980s, caused by the external debt crisis, shows the results of experimentation in The first decade of the 21st century (Estrada 2005, Giraldo 2007). The tendency of the reduction of the States restricted the influence of the same ones in the social spaces due to the crisis of the debt and the neoliberal wave stimulated by the structural reform. The consequence is that "institutional bureaucratic apparatus is still more out of step with social spaces and is increasingly illegitimate and ineffective" (Badie 1992b: 218 in Roth: 2008).

Thus, Latin America at the beginning of the 90's led to the abandonment of the ECLAC model and replaced it with the neoliberal model that was being experienced in Pinochet's Chile by the popular Chicago Boys. Strategies promoted by the World Bank (WB) and the International Monetary Fund (IMF) were categorized as Structural Adjustment Policies (SAPs) (Giraldo 2007) aimed at

renegotiating debts and improving the macroeconomic balances of Latin American countries (including health), in order to resume external financing to those who had lost their debt capacity and payment of external debt due to internal economic crises (López 1994, Hernández 2003, Restrepo 2004). Which, as expressed by Dos Santos, is nothing more than a crisis of the model of economic growth itself.

The hospital crisis experienced in the late 1990s, where it has been documented that more than 60 institutions were closed at national level, the mistreatment and violation of the autonomy of health professionals, and the many denials in the Provision of services was understood by unions of workers in the health sector and academic sectors as a political opportunity to convene another set of actors (such as patients and students) to claim the right to health given the positioning of the problem at the level That allowed for greater identification.

The understanding of social movements through the approximation of political process theory allows us to see the different moments relevant to the activation of collective action, their dynamics in the areas of deployment of strategies and mobilization repertoires as forms of visibilización of repertoires of the popular or subordinate public sphere public.

social movements, Health care, private insurance, judicialization

Social movement and legal activism around the right of prisoners to healthcare

Fiona Macaulay, University of Bradford

Brazil has the fourth largest prison population in the world and many of its prisons very overcrowded. The conditions of detention violate many of the local and international norms, chief among them being the lack of access of detainees to adequate healthcare. This results from: a lack of investment in staff, failure of state-employed medical personnel to do their job correctly, territorial disputes between the prison and health services, and lack of human resources to escort prisoners to external health facilities. This paper examines how, in the face of spreading infectious diseases and untreated ailments, civil society groups (such as the Catholic Church's prison service) and justice system operators, such as the Public Defenders office, have developed campaigning and litigation based strategies to force the state to meet its legal obligation to provide proper healthcare to a very socially vulnerable group.

Brazil; prisons; healthcare; human rights

Right to health in spanish legal system

Vellé Bergado, Gorka, MOVE ABOGADOS

The presentation will deal with the current legal and administrative situation of migrant people in Spain, after the abolition of the free and universal system of health, replaced by an insurance system. This new system entered into force through some Royal Decrees aproved by the Government during 2012.

Due to this new legislation, principles of universality and solidarity in health system are no longer in force. This entails that some people are expressly excluded from the new system (vulnerable groups such as migrants), and that this new system generates an optional system of private insurance excusively for these excluded groups, with fewer services than the rest of the population, which means that, at the end of the day, they can not afford this new system either, because of its cost. Particularly, the presentation will focus on three legal cases, in which the presentator has taken part as litigator and legal advisor of the migrant people. It will be explained the current legal situation,

along with the Public Administration's point of view in these proceedings and the most recent case law in this field. Finally, we will examine the close connection between the right to health as a social right (which means that, in accordance with the Spanish Constitution, there is no direct access to protection as in the case of fundamental rights), and with the right to life and not to suffer inhuman treatments, which are considered as fundamental rights and with a special protection to the eyes of Spanish Constitution.

Fundamental right to health

053. Doctors, Workers and Health: Discussions and Proposals Regarding Occupational Medicine in Latin America, 1920-1970

Ocupational Accidents in Argentina: Theoretical Perspectives

Karina Ramacciotti, CONICET

Desde principios del siglo XX diferentes voces pusieron sobre el tapete la necesidad de impulsar una ley que protegiera a los trabajadores de los accidentes, que les dejaban lesiones o que provocaban su muerte. La sanción de la ley de accidentes de trabajo (ley 9.688) en 1915 en Argentina implicó un cambio en la doctrina jurídica ya que instaló la idea que los problemas relativos al trabajo debían tener jurisdicción legal propia y no quedar incluidos dentro de la legislación civil. Esto constituyó un quiebre en la historia de la legislación, en las relaciones laborales y en la interacción entre las agencias estatales. Asimismo, abrió las puertas para crear los Tribunales de Trabajo.

La sanción de la Ley N 9.688 ratificó la noción de riesgo profesional, ya vigente en Europa y en las legislaciones de otros países de América tales como Perú y Chile. Esto implicó que el patrón debía demostrar legalmente que el accidente había sido causado por la negligencia del obrero. Con lo cual, poco importaba que el patrón fuera o no culpable, lo que interesaba era que existiera un riesgo y, en virtud de él, el empleador debía remediar la desgracia, ya que era responsable de los accidentes de trabajo y de las enfermedades profesionales. Por lo tanto, la sola relación de causa y efecto entre el accidente y el ejercicio del trabajo se constituía en prueba y ponía al patrón en la obligación de impulsar los mecanismos para su atención médica, tratamiento, cura o rehabilitación. También se estipuló que era el Estado quien tenía la obligación de tutelar las relaciones laborales.

En la historiografía, el abordaje del tema fue analizado como un eslabón importante para el estudio del proceso de adquisición de los derechos sociales, pero dentro de estudios generales y sin mayor profundización específica. Ahora bien, muestra postura en torno al surgimiento de las políticas vinculadas a los accidentes laborales y enfermedades profesionales, fueron estudiadas como un proceso en el cual tanto el conflicto social como la relación entre los profesionales, en tanto sus saberes técnicos como políticos, permitieron comprender el proceso por medio del cual el Estado fue creando agencias cada vez más complejas con el objetivo de intervenir en las relaciones sociales. Conjugar estas perspectivas nos permitió conocer el entramado de intereses, vernáculos e internacionales, que se pusieron en juego para delimitación una política pública.

Accidentes laborales, conflicto social, reformas sociales

The Dirección de Higiene y Seguridad del Trabajo: tensions regarding the construction of a new function in the peronist State

María Paula Luciani, Instituto de Altos Estudios Sociales - Universidad Nacional de San Martín

During Juan Domingo Perón's presidencies (1946-1949/1952-1955), the Argentinean State went through a period of profound transformation. The Executive Power became more complex as new areas of intervention appeared. Among them, the creation of the Secretaría de Trabajo y Previsión, in 1943, and then of the Ministry, six years later, were especially relevant.

The internal organization of this area included the construction of a direction which intended to influence and control security and hygiene conditions in a wide range of work environments. Dr. Leopoldo Bard, a figure of long professional and political experience, became the head of this Direction. The building of this section involved tensions with the Secretaría de Salud Pública as both departments were interested in the preservation of the worker's health as part of a wider purpose to develop massive sanitary services. It also represented the use of knowledge linked to work medicine, still an unsteady field in the mid-twentieth century Argentina, where several professions met and exchanged their expertise.

Through the analysis of specialized and state publications, in the first place, this work will reconstruct some highlights of the work medicine field conformation's process during the first decades of the XXth century. Then, we will focus on the organization and functioning of the Dirección de Higiene y Seguridad del Trabajo of the Secretaría de Trabajo y Previsión during the years of the so-called "first peronism".

work medicine; Secretaría de Trabajo y Previsión; first peronism

Illnesses and occupational diseases in the origins of the International Labor Organization (1919-1930)

Norberto O. Ferreras, Universidade Federal Fluminense

Since the beginning of the International Labor Organization, occupational diseases and professional illnesses have been present at the Congresses and in the concerns of the delegates. If diseases and occupational diseases were included in the list of issues that would be covered by the ILO, this was partly because this issue was of concern to various agents involved in the world of work. Workers' representatives, state health services, social reformers and even some of the entrepreneurs were involved in the effects that labor could have on human beings, and this concern is evident in the debates and positions of the first decade of the ILO.

Occupational Diseases; International Labor Organization; Professional Illnesses

Medicine, technology and workers: cardiology as a specialty in Brazil (1930s-1940s)

Simone Petraglia Kropf, Oswaldo Cruz Foundation (Fiocruz)

Joel D. Howell, University of Michigan

This paper analyzes the institutionalization of cardiology as a medical specialty in Brazil during the 1930s and 1940s, focusing on how the new technology of electrocardiography was used to establish new medical attitudes and practices regarding cardiac patients as well as to legitimize cardiologists' professional identity. During this period work relations were reorganized according to new social

security and labor laws. Physicians claimed that heart disease, one of the main causes of mortality and disability among urban workers, should be considered as a major part of the Brazilian medical and political agenda. The medical debate on the importance of heart diseases was closely tied to broader political discussions about the 'new Brazilian worker'. While Getúlio Vargas's government (1930-1945) constructed new systems to provide social protection and medical assistance for workers (such as the Retirement and Pension Institutes and the hospitals linked to them), physicians produced new statistics on heart diseases and created specialized cardiology services. In these spaces, cardiologists expanded and valued the use of the EKG both as an expression of their competence to diagnose cardiovascular diseases that could affect workers' productivity, and also as a marker of their ability to provide social assistance to cardiac patients in order to maintain their work capacity. A notable feature of this process was the intense exchange with U.S. physicians, particularly Frank Norman Wilson, a University of Michigan professor who in the 1930s developed new techniques for clinical applications of the EKG. In addition to receiving several Latin American physicians for electrocardiography training in Ann Arbor, Wilson was funded by the Division of Cultural Relations of the United States Department of State to visit Rio de Janeiro and São Paulo in 1942. He offered an intensive course of electrocardiography and lectured at the most important medical institutions in both cities. In a time when the "good neighbor" policy and inter-American cultural diplomacy promoted intense circulation of scientific knowledge and practices between Brazil and the U.S. (especially during WWII), the links between the so-called "Wilson School" and Brazilian physicians were decisive for the creation of the Brazilian Society of Cardiology in 1943 and for the legitimization of Brazilian cardiologists as specialists.

"Cardiology"; "electrocardiography"; "workers"; "Frank Wilson"; "Brazil"

054. Cancer Studies: Historical and Social Sciences Perspectives

Cancer and tobacco control policy in Mexico

Ana María Carrillo Farga, Departamento de Salud Pública, Facultad de Medicina, UNAM

Some 19th-century Mexican physicians associated the use of tobacco with the development of cancer. Nowadays positive association has been confirmed for smoking and death from cancers of the lung, mouth, esophagus, pharynx, larynx, pancreas, and bladder, among other diseases. The highest mortality due to cancer worldwide for both genders corresponds to lung cancer, and smoking is the main risk for it. Mexico still has 10 million smokers, two of three physicians and one-fourth of adolescents smoke, and every year more than 46,400 of its people are killed by tobacco-caused diseases. Mexico was the first Latin American country to ratify, in May 2004, the World Health Organization's Framework Convention on Tobacco Control, but it took only 21 days for Mexican officials to break a key promise of the pact: to keep tobacco companies away from the process of how nations decide to implement the treaty. The International Consortium of Investigative Journalists found an unusually close relationship between the industry and government regulators. Carlos Slim, with tobacco interests and Health Minister Julio Frenk struck a deal that postponed the WHO rules and Congress passed a new tax on cigarettes; the industry agreed to charge a fee per pack to consumers which would go to a special fund at the Health Ministry. Outside Mexico this agreement was criticized, and that is why Mexico was known as "the dirty ashtray". The real test has been enforcement. Since 2000 smoking was prohibited in federal buildings in Mexico City; but many years later, legislators smoked even during the debates about the antismoking measures; law still allows advertising and promotion aimed at adults; and two chains of casinos in Mexico's northern states won an amparo trial against no-smoking laws. It is not a surprise that while the adjusted mortality rate from lung cancer declined from 7.91 per 100 000 in 1989 to 5.96 per 100 000 in 2000, morbidity and premature death due to lung cancer are greater in those states. The paper focuses on how health care and campaigns have changed during the last decades; the difficulties imposed to

them by the powerful economic interests of tobacco companies; the important role played by significant actors, including the civil society (Aliento, Alianza contra el Tabaco), and the debates about smokers' rights and the need to protect others from second hand smoke.

cancer, smoking, Convention on Tobacco Control, Mexico

Sign of development or disease of poverty? The status of cancer to brazilian medicine (1950 – 1970)

Luiz Alves Araújo Neto, Casa de Oswaldo Cruz/Fiocruz

Luiz Antônio Teixeira, Fundação Oswaldo Cruz

This paper analyses the framing of cancer by brazilian medicine between 1950 and 1970. Considered a health issue much more connected with most developed, industrialized and urbanized countries, cancer was approached in many ways as a “sign of development” in brazilian medical field. Most of physicians interpreted the increase of mortality and frequency rates on brazilian cities as a consequence of the industrialization process on going during the 1950s and 1960s in Brazil. That perception was articulated with the development political platform of federal governments to support both anticancer campaigns institutionalization and the ideia that Brazil was acctually becoming a developed country. However, in the 1960s a new interpretation of the increasing of rates organized other form to think cancer, putting the disease as problem of poor populations and an unorganized public health system. That interpretation gained importance in brazilian northeast, where tumors like cervical cancer were common among poor people. We argue that such transformation relates mainly with two different aspects: the organization process of medical knowledge and pratice, and the crossing of medical knowledge about the disease and interpretations of brazilian society.

Cancer; Development; Poverty

The control of breast cancer in Brazil

Luiz Antonio da Silva Teixeira, Fiocruz

Luiz Alves Araújo Neto, Fiocruz - COC

This paper aims to study the actions for the control of breast cancer in Brazil, analyzing the development of knowledge and medical practices about this disease and its consolidation as a health policy. The analysis will contemplate the development of surgical techniques for treating the disease during the first half of the 20th century, the emergence of chemotherapy from the 1950s and the development of different forms of early diagnosis as self-examination and clinical breast exams. In this regard, we focused primarily on the development of mammography in the 1970s and the debates and controversies related to the possibilities and limitations of breast cancer prevention from the use of this technique.

Currently, the medical discourse on breast cancer suggests that the disease is strongly related to contemporary life modes, and that its control should be based on primary prevention, broadening early diagnosis and improving treatment quality.

With this research we aim to broaden the understanding of the technical development, changes in the understanding of the breast cancer in the lay and scientific scope and the demands of social movements for actions for its control, showing how these aspects helped shape policies directed to this disease.

Breast cancer; history of medicine; history of public health

Developmental cancer: the control of breast cancer in Ceará between the 1960s and 1980s

Thayane Lopes Oliveira, Casa de Oswaldo Cruz - FIOCRUZ

Currently, in Brazil, malignant neoplasms occupy the second place in the mortality ranking. According to the data from the National Cancer Institute José Alencar Gomes da Silva - INCA, breast cancer has the highest incidence rate among women in all regions of the country, except in the Northern region, where cervical cancer Prevails. A historical analysis of breast cancer shows that this scenario has been built decades ago. The mortality statistics of the 1970s and 1980s pointed to the growth of cancer in women in Brazil, with gynecological cancers being the most recurrent. Considering this information and consulting the literature on the subject, we noticed that from the second half of the 1960s and especially in the 1970s, gynecological cancers gained more attention in the public health sphere. This period represents the moment of greater attention to gynecological cancers and the appearance of initiatives of prevention and early diagnosis for the control of such diseases. Thus, laboratories and prevention services, as well as national cancer control campaigns were created to raise awareness among women about the need to know their own body and the risk factors for cancers specifically for our study, Awareness about breast cancer. In view of the above, our research aims to understand how and at what point breast cancer has gained public health attention in Brazil. Thus, we intend to analyze the process of organization of breast cancer control actions in Ceará in the decades mentioned above, relating the context of Ceará with national initiatives. We will contemplate the performance of the cancer services for the control of the disease in the state, as well as the use of the newspapers for the delivery of these services and the ideas of prevention and early diagnosis of breast cancer. For the development of this research we will use the documents of two main services of cancer care in the state, the Cancer Institute of Ceará - ICC, and the Institute of Cancer Prevention of Ceará - IPC; as well as the newspapers O Povo and Diário do Nordeste; And the medical publications Revista Ceará Médico and the Journal of the Faculty of Medicine of the UFC.

"Controle do câncer de mama"; "Ceará"; "História"

Biomedical knowledge, gender and health system intersections: The case of hormonal treatment for breast cancer in Argentina

Yolanda Eraso, London Metropolitan University

Hormonal treatment for breast cancer is regarded as one of the most remarkable developments in the history of cancer therapy. Endocrine treatments for breast cancer in Argentina have a long and rich history of application in clinical practice, dating back to the 1940s when beneficial therapeutic outcomes were obtained with the use of testosterone in women with advanced stages of the disease. After outlining its historical configurations, this paper will explore the preliminary results of a qualitative study that aims to identify how the intersections of gender values, health system providers, and endocrine knowledge influence doctors' clinical use of hormonal treatment. In doing so, it will also evaluate the potential role of these intersections in relation to persisting health inequalities in women affected by the disease.

Breast cancer; hormonal treatment; intersectionality; inequalities

056. Historical Epistemology and History of Medical and Biological Thought / Épistémologie Historique et Histoire de la Pensée Médicale et Biologique

Le concept de gazométrie: une histoire de l'interaction de la chimie, de la physique et de l'informatique dans la médecine

Amaziles Ferreira Gonçalves, Universidade Federal de Ouro Preto

Ana Lucia Rissoni dos Santos Regis, Universidade Federal de Ouro Preto

L'analyse conceptuelle de la "gazométrie" souligne l'appropriation des connaissances en chimie, en physique et en informatique dans le savoir médical et illustre l'affaiblissement du vitalisme dans la médecine. La gazométrie se définit comme une lecture du PH (potentiel, hydrogène) et des pressions partielles des gaz sanguins, oxygène (PO₂), et dioxyde de carbone (PCO₂) dans un échantillon prélevé. La lecture est obtenue en comparant ces variables analysées aux paramètres préétablis dans un gazomètre. Cliniquement, la lecture indique la capacité pulmonaire et/ou l'équilibre acide-base de l'organisme vivant. Épistémologiquement, le concept de gazométrie se dérive du principe de l'iatrochimie. Au XVII^e siècle, les travaux des iatrochimistes Jean Baptiste Van Helmont et Franz de le Boë constituent des éléments du concept de gazométrie dans leurs théories, tels que: le gaz, la conception d'une physiologie par la fermentation et les réactions acide-base, dégageant ainsi le principe de maladie régit par l'excès acide ou alcalin. À la fin du XVIII^e et au début du XIX^e siècles, la physique s'impose à travers les travaux de William Murdoch, ingénieur qui propose le nom de "gazomètre" à un appareil. Au XX^e siècle, le déroulement des études enzymatiques est générateur des concepts de substance tampon et de PH. Henderson élucide les systèmes tampons : bicarbonate, rein et hémoglobine. Poursuivant la recherche de Henderson, Hasselbach formule une équation d'application clinique qui détecte les troubles acido-basiques. Au milieu du XX^e siècle, le concept de gazométrie apparaît, dérivé des mots gaz et metria, de metron, du grec, mesurer, en désignant une procédure analytique du pH physiologique et de sa relation avec les gaz du sang. De même, on observe l'influence de l'informatique dans ce concept quand les fabricants de gazomètres cherchent à les miniaturiser, simplifier l'automation et l'informatisation. Aujourd'hui, la gazométrie est calculée en utilisant le monogramme de Sigaard-Andersen embarqué dans le gazomètre. En bref, l'analyse historique-conceptuelle du mot «gazométrie» renforce et éclaircie la thèse de Canguilhem d'une médecine non scientifique, mais une technique s'appropriant des connaissances de sciences diverses.

histoire conceptuelle; gazométrie; iatrochimie; physique; informatique

The philosophy of Gilbert Simondon and the notion of relation in biology

Dina Czeresnia, FIOCRUZ - Oswaldo Cruz Foundation

Rita Daniela Fernandez-Medina, ENSP-FIOCRUZ

Knowledge is grounded historically and its discourses represent the condition of their possibility within a particular epoch. In agreement with Foucault's we could say that recent scientific changes are in consonance with discourse's transformations and with new realities built by technic. Transformations in contemporary experience qualify a set of scientific changes that questioned the biological concept of individual and the biological notion of interaction, especially once symbiosis has been recognized as a central phenomenon in the constitution of the biological individuality at its various organizational levels. From the results of experimental research in areas such as genomics, development, immunology or neurosciences, theoretical biology requires a rethinking of the notions and concepts that settled the emergence of biology as a science in the XIXth century. The construction of the concept of organism, the cellular theory and the notion of relationship between organisms and environments were the foundational bases of this science. Living beings were

understood as organized structures that develop and auto-preserve in uninterrupted relationships with external elements from the environment, yet conceived in a dual manner. This dichotomy was problematized by George Canguilhem and later by Gilbert Simondon, successor of the same french philosophical tradition. Simondon's philosophy has affinities with a line of recent studies and empirical observations that emphasize the interdependency of the couple organism / environment, at the same time that search for a qualification of "relation" (or interaction) within biology. He conceived individuality in terms of ontogenesis, as a continual process of permanent individuation, departing from a reality which precedes the constituted individual, and allows the constitution of the couple organism / environment. Life, under this perspective, would not be possibly defined only based on the description of its minimal unit; rather life would originate in the reality of relations. Simondon is increasingly being studied, mainly in the human sciences. We present a study of the notion of relation within biology and introduced the reading of Simondon, as a promising alternative to advance a contemporary epistemological debate within the life sciences.

phylosophy of biology, Simondon, relation, individuation, biological individual

Aux sources d'une philosophie biologique: Canguilhem lecteur de Bergson

Fábio Ferreira de Almeida, Universidade Federal de Goiás

L'hypothèse que j'entends présenter ici s'inscrit dans une conception générale de la philosophie de G. Canguilhem comprise comme une philosophie biologique. Comment comprendre l'expression « philosophie biologique » ? La réponse doit initialement prendre en considération une distinction classique que la biochimie, au XXème siècle, a fini par abolir : « la différence de nature entre le vivant et le non-vivant ». Toute problématique relative à l'être vivant, d'Aristote jusqu'à la distinction cartésienne entre l'âme et le corps, se fonde sur cette séparation qui, finalement, semble indépassable. Néanmoins il ne s'agit pas d'affirmer que la matière inerte vit, mais plutôt de reconnaître qu'elle se présente comme un organisme vivant à un niveau tel que le 18ème siècle ne pouvait même pas l'imaginer : au niveau microscopique. En 1973, Canguilhem attirait l'attention sur le fait que c'est « par la miniaturisation croissante de leurs objets, bactérie, gène, enzyme, que les biologistes ont enfin découvert à quoi tient la vie ». C'est tout le problème d'une philosophie biologique qui, certainement, dépasse de loin tous les vitalismes simplement philosophiques. Au niveau de la structure moléculaire de l'ADN, en effet, il n'y a que de la matière et pourtant, les liaisons intermoléculaires ne cessent d'y transmettre des informations. C'est cet échange de messages entre matières qui sépare le matérialisme des biologistes d'une compréhension mécaniciste de l'organisme. Une philosophie biologique ne peut donc laisser dans l'ombre la relation entre les microstructures du vivant et la matérialité mouvante et vitale du monde, c'est-à-dire le milieu dans lequel le vivant vit. Après le compte-rendu élogieux du pamphlet de G. Politzer, La fin d'une parade philosophique: le bergsonisme, l'attention d'un Canguilhem alors formé à l'école des biologistes, à toutes ces questions, l'a en quelque sorte reconcilié avec la philosophie de Henri Bergson. C'est ainsi que le Canguilhem de la maturité peut affirmer cette quasi devise de la philosophie biologique, imprégnée de bergsonisme: « L'intelligence ne peut s'appliquer à la vie qu'en reconnaissant l'originalité de la vie. La pensée du vivant doit tenir du vivant l'idée du vivant ». Parallèlement à l'immersion de la réflexion de Canguilhem dans la matérialité biomédicale, philosophiquement, c'est pour le moins l'hypothèse que j'aimerais présenter, c'est dans le bergsonisme que Canguilhem, épistémologue et historien, puise.

Canguilhem, Bergson, biologie, vie

Evolution and Processes Life by Ernst Mayr

Flávia Maria da Silva Veiga, Universidade do Estado do Rio de Janeiro

André Vinícius Dias Senra, Instituto Federal de Educação, Ciência e Tecnologia do RJ

The objective of this work is to present a discussion about the different ways of the concept of Life to the point that it becomes an effective learning. Thus, we re-read a reading that involves an epistemological consideration, since scientific research is guided by data. If we look at this question in the purely scientific sense, we would have to indicate a form of treatment that would establish testable functions and models. From the epistemological point of view, it is understood that this is a matter of scientific frontier which implies an approach that takes into account the philosophy and history of science. Although this proposal is in accordance with the ideas of the biologist Ernst Mayr, it also involves in a comparative way other thinkers such as philosopher Aristotle, Mendel, Darwin. The methodology used was the primary and secondary bibliography on the subject, which infers the option to compare models that contributed to the development of Biology. e scientific method versus other forms of knowledge, the distinctive features of scientific theories, with particular attention to its formal structure. But rather, the aspects that are linked to biological research itself, such as the concept of species and adaptation, the discussion about the possibility of progress through Evolution, the determination of the units or levels in which natural selection acts. The process of development of biological evolution has implied changes in the population characteristics of living organisms over time. Natural laws apply to biology in the same way as apply to physical sciences. Evolutionary biology - Knowledge of history is not necessary for the explanation of a purely functional process. However, it is indispensable for the explanation of all aspects of the living world, which involve the dimension of historical time - in other words, as we now know, all aspects that deal with evolution. The development of the discipline meant a change in the framework of issues that occupied the agenda of the physics-centered philosophy of science in the twentieth century. The dominant questions of the philosophy of biology do not concern the specificity of the scientific method versus other forms of knowledge, the distinctive features of scientific theories, with particular attention to its formal structure.

vida; paradigmas; epistemologia; evolução

Pour une cartographie de l'articulation vie et technique chez Canguilhem

Carlos Estellita-Lins, Ictt-Fiocruz

Flavio Coelho Edler, COC-Fiocruz

Nous supposons que le l'oeuvre de Georges Canguilhem (GC) est situé dans l'histoire de la science/épistémologie d'une façon très particulière, en s'inscrivant dans la tradition de la philosophie française du concept et de la discontinuité. Il s'agit d'insister sur une conception de la vie, tout en revisitant le sens du connaître chez la philosophie et la science - la connaissance de la vie, et aussi, la vie comme connaissance-savoir (technique).

GC est situé dans un débat complexe sur la technique, la technologie et l'action humaine parmi une problématisation de l'articulation du vivant et de la vie. Le corpus de textes publiés chez Les Œuvres Complètes est fondamental pour ce dessein, faisant signe de ses principaux interlocuteurs. Nous soulignons comment GC cherche à redéfinir la portée des connaissances scientifiques et technologiques en mettant l'accent sur la thérapeutique, l'évolution darwinienne et l'organisme.

Nous essayons d'indiquer et suivre ses liens avec la première génération des historiens des Annales, qui éclaire la mis en question de la technique et de la machine, usager entre les deux guerres chez les études de science et technologie. Il ressort également un intérêt pour la géographie et le territoire, caractéristique de sociologues et des géographes de cette génération de Strasbourg, typique dans la production de Lucien Febvre.

L'influence de GC sur les auteurs qui étaient ses contemporains ou non, comme Simondon, Ruyer et Dagognet est une indication supplémentaire. Cependant, il est particulièrement nécessaire de noter le rôle de Bergson dans la discussion de la technique. Il est remarqué en GC la réception du problème bergsoniste des techniques vitales et leur relation avec l'intelligence ou la discussion de l'évolution des espèces, reconsidéré à travers l'histoire de la médecine et de la biologie.

Le raisonnement centré sur la notion de normativité vitale du vivant, issue du vitalisme, est directrice de plusieurs réflexions épistémologiques de l'auteur, pendant des années 1940 et 1950, branchée sur le problème du mouvement dans ses rapports avec les modèles mécaniques attribués au vivant (soit-il dans la distinction entre mécanisme et organisme soit il chez l'histoire du concept de reflexe) La compréhension de ce genre de problème permet saisir leur apport complexe entre science et technique.

Georges Canguilhem; technique; vie; normativité; Annales

What was “serious philosophy” for the young Bergson? Philosophy and the sciences of the psyche around 1880

Giuseppe Bianco, USP

In a forgotten letter of 1880 (later published in an issue of the now forgotten journal *Le Papetier Libraire*), Henri Bergson confesses to a schoolfellow his intention to study medicine once completed his degree in philosophy. According to him, the study of medicine is the necessary condition to “do serious philosophy.” Bergson never went to the faculty of medicine, as did other French philosophers who turned to psychology, such as Pierre Janet, Georges Dumas, Daniel Lagache and Ignace Meyerson. Nonetheless, in his doctoral thesis, in *Matter and Memory*, and in many lectures and conferences, Bergson constructs his arguments in a close relation with questions emerging from disciplines like psychology, psychopathology and neurology.

In this article I will start from the French history of the confrontation between philosophy – as institutionalised as discipline by Victor Cousin during the 1820s – and the emerging “positive” approach to human phenomena, namely medicine, physiology and neurology. I will explain why the confrontation between the positive and the philosophical approaches to human phenomena implied complicated political and ideological stakes dealing with the structuration of the different disciplines and academic fields and their relation with State administration.

I will then move to the emergence of “scientific” psychology around 1860 and to the attempt of an *aggiornamento* of philosophy as a discipline through the introduction and translation of the work of Immanuel Kant. Describing the way in which the philosophical was polarized between neo-Kantianism (Renouvier, Lachelier, Boutroux) and the new “scientific” psychology and sociology influenced by Spencer and the theory of evolution (Ribot, Espinas), I will give a comparative prosopographic account of Bergson’s and his classmates’ trajectories to seize their common problems and to understand his attempt to operate an update of spiritualism able to adapt and fight again the new “positive” approaches to man.

Neurology, philosophy, psychology

Un nouveau Canguilhem ?

Jean-François Braunstein, Université Paris 1 Panthéon-Sorbonne

L'édition en cours de ses Œuvres complètes et la mise à disposition de ses archives au Caphés à Paris ont transformé la vision que l'on peut avoir de l'œuvre de Georges Canguilhem. Une nouvelle

génération de chercheurs s'intéresse actuellement à celui qui n'est désormais plus seulement connu comme l'élève de Bachelard et le maître de Foucault. La connaissance des cours et des manuscrits a notamment permis de découvrir de nouvelles sources de la réflexion de Canguilhem, par exemple la psychanalyse ou la géographie humaine.

L'histoire des sciences telle que Canguilhem la pratique prolonge, mais transforme aussi, ses engagements philosophiques et éthiques, voire politiques, antérieurs. Son choix d'étudier la médecine tient ainsi à ce qu'il s'intéressait auparavant à la technique comme lieu de la création et à la question philosophique des valeurs et des normes. Canguilhem retrouvera également par la suite certains des sujets qui le faisaient violemment réagir dans sa jeunesse (conception déterministe du milieu, critique de la psychologie ou de la sociologie durkheimienne) mais il les traitera alors d'un point de vue épistémologique : il démontrera que ce qu'il savait être injuste était aussi faux. Canguilhem le dira lui-même : « Je ne suis pas véritablement un historien des sciences, je suis en fait un professeur de philosophie qui s'intéresse à un certain nombre de questions, qui sont les rapports entre la philosophie et la science et en particulier celle de la fabrication, de la naissance, de l'importation et de l'exportation d'un certain nombre de concepts interprétatifs de fonctions biologiques ». Nous essaierons de montrer que cette nouvelle pratique, philosophique, de l'histoire des sciences peut d'une certaine manière être identifiée comme une des origines de l'« historical epistemology » contemporaine.

Canguilhem ; historical epistemology ; medicine ; philosophy; Foucault

Normativity in health practices and knowledge: Georges Canguilhem and the "Saúde Coletiva" in Brazil

José Ricardo de Carvalho Mesquita Ayres, Department of Preventive Medicine - Medical School of the University of São Paulo

Historical epistemology has played an important role in the development of a movement of renewal of the Brazilian Public Health since the 1970's, called "Saúde Coletiva". Born as an academic search for new conceptual foundations of a social committed field of scientific knowledge, as well as a social political movement against civil-military dictatorship implanted in Brazil in 1964, the so called Brazilian Sanitary Reform Movement found in the French historical epistemology, particularly in the works of Georges Canguilhem, a powerful ally. This study aims to revisit the main features of this relationship, focusing in particular the inaugural works of Sergio Arouca and Cecília Donnangelo and the Health Work Process Theory as developed in the Department of Preventive Medicine of the Medical School of the University of São Paulo. The discussion is centered in the way Canguilhem's philosophical concepts, in particular the normative character of life and of its knowledge, were crucial to promote the intertwining of the political and academic goals of the movement and still remain a challenging element for the development of this field's philosophical and historical reflections.

Public Health/History; Preventive Medicine; Social Medicine; Epistemology; Georges Canguilhem

About a metaphysics for the History of Science

Karina Silva Gracia, Facultad de Humanidades y Ciencias de la Educación - Universidad de la República, Uruguay

Rita González, Facultad de Humanidades y Ciencias de la Educación

According to Lorraine Daston, the aim of Historical Epistemology is to "revive ontological questions in the History of Science" (2000: 01). According to the author scientific objects are historical, changes, may disappear according to what the author calls an "applied metaphysics." This metaphysics, which is fundamentally based on Aristotle's "sublunary metaphysics of change", would allow us to explain the degrees of reality of the real (Id.). But how can we explain an increase in the reality of something that is already real? Answering this question leads us to inquire about several epistemic and ontological assumptions in which it is worth stopping

According to Daston the increase in knowledge of an object comes accompanied by a modification in the object without its essential characteristics being altered. But what kind of modification does the author refer to with this statement? Is there a change in the ontology of the object? Moreover, can the concept of Aristotelian change be useful in explaining this modification in objects? According to Daston, as a result of these modifications, objects and in particular scientific objects, have historicity. Addressing the historicity of scientific objects allows, according to the author, to understand the changes that take place in the object itself. This change, which does not involve a transformation in the object, does lead to an increase in the reality of the object. But if this is so, would we not fall into an overlap between the epistemic and the ontological plane? Or, could we think of this transformation in terms of being-in-act and being-in-power in the Aristotelian sense? Moreover, according to Aristotelian physics, movement and change is an undeniable reality and a fundamental characteristic of nature (Aristotle). Therefore, we could argue that the more we know an object, the more we approach its constitutive "matter", so we approach that which does not change. If this is so, is the sublunar Aristotelian metaphysics enough to explain the increase in the reality of scientific objects? From these questions the objective of the present work is to approach the proposal of Daston in the light of the Aristotelian philosophy. In other words, our purpose will be to trace the explicit and implicit Aristotelian assumptions throughout Daston's work. To fulfill this purpose, the analysis will be structured according to three main concepts: change; Sublunary metaphysics; and, being-in-power and being-in-act.

Historical Epistemology; Metaphysics; Ontology

La médecine dans la critique de Foucault des sciences humaines

Kleverton Bacelar, Universidade Federal da Bahia

Le but de cette communication est d'examiner le lieu prit par la médecine à l'archéologie de Foucault des sciences humaines. De l'analyse de la Naissance de la Clinique (1963), je souhaite montrer la position architecturale de la médecine dans la constitution des sciences humaines. Puis, en examinant l'archéologie foucauldienne des sciences humaines faites dans les Mots et les Choses (1966), montrer le pôle clinique de ces sciences. Enfin, discuter des effets de normalisation de ces sciences au tournant développé par la généalogie du pouvoir à partir des années 1970.

médecine; sciences humaines; l'archéologie du savoir; Michel Foucault

Critical thinking in Collective Health in the 70'S and technology in health practices: Donnangelo and Mendes-Gonçalves contributions

Lilia Blima Schraiber, University of Sao Paulo/Medical School

André Mota, University of Sao Paulo/Medical School

José Ricardo Carvalho mesquita Ayres, University of Sao Paulo/Medical School

The 70's witnessed in Brazil the onset of a movement of critical thinking that gave foundations during the two following decades to an influential reconstruction of health practices and knowledge that came to be known as Collective Health. Beginning with the historical opportunity of the introduction in the 50's and 60's of the innovative (for that time) Preventive Medicine, Comprehensive Medicine and Community Medicine in Brazil, originated in the US, the Collective Health movement flourished in this country. Its main aims were to integrate public health and medical knowledge, through a fresh look and a new way of articulation geared towards an active quest for equity and social justice, as well as a concern regarding citizens' rights and political participation. Their leaders formulated and launched a politically engaged Collective Health movement committed with social reform and with the reform of the Brazilian state, being also epistemologically based in social, historical and philosophic foundations linked to humanism. In this context, the common ground that Maria Cecilia Ferro Donnangelo, (a pedagogue) and Ricardo Bruno Mendes-Gonçalves (a physician) share is their criticism both intellectual and political, to the presumed neutrality of health techniques and science, to the reified autonomy of its technologies and to the social alienation of its agents. Donnangelo and Mendes-Gonçalves collection of intellectual production, pillars of Collective Health, contributed to this construction benefiting from the use of an unprecedented and productive dialogue among solid sociological Marxian references, the historical epistemology coming from Canguilhem and the Foucauldian archeology of knowledge. This paper is based on the research The History of Collective Health in Sao Paulo state funded by Sao Paulo Research Foundation (Fapesp) grant 2013/12137-0.

Public Health History; Preventive Medicine; Medical technology; Interdisciplinary Critical Thinking

Historical Epistemology and self-techniques. Psychoanalysis of objective knowledge and epistemological vigilance

Marcela Becerra Batán, Universidad Nacional de San Luis

In this paper we will ask: i) whether psychoanalysis of objective knowledge and epistemological vigilance proposed by Bachelard can be understood as self-techniques, in the sense defined by Foucault; ii) if so understood, can serve as keys to the reading of diverse texts, highlighting in them the "epistemological moments" in which communities or subjects of knowledge have performed psychoanalysis of objective knowledge and / or epistemological vigilances. Readings that can also contribute to historical analysis "of the pragmatics of itself and the forms adopted by it" (Foucault, 2009); and finally, (iii) whether psychoanalysis of objective knowledge and epistemological vigilance are valid, under the current conditions of scientific work and epistemological exercise in the sciences of human life, in the contemporary net of: production of truths, practices of government and constitution of subjectivities. We will deal with these issues from the perspective of Historical Epistemology, as a peculiar style (Braunstein, 2002), which commits us to a critical and reflexive exercise on the history and the actuality of problematizations and practices related to the sciences of human life, as well as the reinvention of techniques of self, in view of the creation of freedom.

Historical Epistemology; self-techniques

Nervous system and adaptation: ideas of sensitivity and ideas of action

Marcos Camolezi, Universidade de São Paulo / Université Paris 1 Panthéon-Sorbonne

We intend to expose how the problem of the origin of muscular sensitivity in the nineteenth century was directly related to the philosophical conceptions about the muscular movement and the adaptive action. Throughout that century, the problem of the origin of muscular sensitivity composes an extensive chapter in the history of the nervous system and reflex movement. Before the work of Ch. H. Sherrington on the reflex movement at the beginning of the twentieth century, the function of the sensory nerves was not precisely known, so its interpretation should be therefore assumed. Maine de Biran is one of the earliest exponents of the concept of central nervous sensitivity. His notion of effort derives from a hyperorganic cause; It does not concern the muscular sensibility, but the resistance imposed from the outside against the executed movement. Other scientists, such as J. Müller, A. Bain and W. Wundt, will defend in a similar sense the fundamental role of motor inflow emitted to the periphery in the formation of internal sensations. Contrary to the hypothesis of sensations of innervation, the hypothesis of peripheral sensitivity, informed from the medical field by Cl. Bernard and several other authors, predicts that muscle movement is felt from the periphery of the nervous system and thus can be effected independently of the sending of motor commands. A radicalized version of this hypothesis was presented by William James, for example, who believed that innervation sensations are irrelevant. A moderate version is that of John Hughlings Jackson, for whom the muscular sensations play a fundamental role in the constitution of the psychological life. Based on this discussion, we seek to understand the polarization of the diverse conceptions of the passage from ideas to motor actions. We will see that these conceptions have a first order biological orientation, since they aim to interpret, based on the physiology of the nervous system, how the organism acts and constitutes its environment.

Action; Adaptation; Nervous system; Sensitivity

Trois étapes du concept de cosmo bioplasmique

Maurício de Carvalho Ramos, Universidade de São Paulo

Dans son ouvrage «Le problème de la connaissance dans la philosophie et la science moderne», Ernst Cassirer présente un concept de force dans laquelle j'identifie une fonction épistémologique que je vais appliquer à l'étude historique de la notion de bioplasme universelle. Cette conception de la force est proposée dans le cadre de la contribution de Kepler à la formation de l'idée moderne de nature. Selon Cassirer, la connaissance de cette nature dépend d'une fusion des concepts de force et de vie, de sorte que "seulement si nous concevons la force comme l'extériorisation d'un sens immanent de la vie, nous arrivons à comprendre le monde des objets". Je propose que cette combinaison de force et de vie trouve l'unité dans un concept de matrice universel dynamique génératrice de tous les êtres naturels, soit dans le plan terrestre ou céleste. Je montrerai que cette forme a également une fonction épistémologique qui s'exprime historiquement dans deux concepts développés au début du XXe siècle: ; un concept d'être primordial (1911) développée par Martin Kuckuk sous la forme de sphères constituées de trois couches concentriques qui représentent trois phases métamorphiques: la couche formatrice, la couche en formation et la couche formée; et le concept de «bioproteon» (1914), de Raphaël Dubois, qui relie les idées de vie, de métamorphose et de l'évolution. En conclusion, je vais proposer que Kepler, Dubois et Kuckuk sont trois expressions morphologiques d'une unité dynamique vitale que je comprendrai comme étapes épistémologiques historiques d'un concept bioplasmique de cosmos qui contient différentes façons de externaliser le même sentiment intérieur de la vie.

Epistemologie historique, Cassirer, Bioplasme, Proteon, Kuckuk

Gothic Universities, Aristocratic Academies, Bourgeois Revolution and Georges Cabanis: Archaeological roots of medical education in Brazil

Naomar Almeida-Filho, Universidade Federal da Bahia

In 1792, at the height of French Revolution, Antoine-François de Fourcroy (1755-1809) proposed re-creating the French education system through the "free teaching of science and the arts" and restructuring the health training within a "medicine in freedom" with the deployment of Health Schools aimed at graduating officers de santé. However, as pointed out by Foucault, the political order had other plans. In the field of medical practice, the winds of restoration initiated by the Directory and later consolidated by Bonapartian Consulate suppressed revolutionary proposals more radically oriented towards human emancipation. In this context, one of the intellectual leaders of the recovery process of the traditional values, adjusted to the cultural matrix of the nascent bourgeoisie, was Pierre-Jean Georges Cabanis, a leader of the famous group of ideologues. Cabanis was also a reformer of clinical practice and medical education who laid the conceptual foundations of the faculty-based education model implemented in France after the French Revolution which, in turn, influenced educational systems in many Latin American countries during the 19th century. Based on this ideological matrix, Faculties of Medicine were implemented in Rio de Janeiro and Bahia circa 1835, followed by Law schools in São Paulo and Recife, along with polytechnics and mining schools. The empire of faculties consolidated in Brazil with a higher education model without universities, undergraduate degrees with direct entry, closed curricula and diplomas for licensing professions, fully adopting the guidelines of the Cabanis Reformation. This paper is structured upon the hypothesis that the Brazilian hegemonic model of medical education today is still organized under a Cabanisian perspective, based on faculties, with curricula formed by disciplines, traditional pedagogical models and submission to the logic of professional corporations. For better understanding these anachronisms or archaeological roots, I first present a summary of biography and oeuvre of this important physician, philosopher, political leader and social activist. Second, I introduce Cabanis' medical education reform plan, taking some of his texts as documentary source. Finally, to assess in a preliminary way the consistency of this hypothesis, I highlight the main structural elements of the Cabanisian model in order to verify the impact of this proposal in Brazilian higher education, with special focus on medical education.

higher education, medical education, historical epistemology, Brazil, Cabanis

The simulators: truth and power in the psychiatry of José Ingenieros

Sandra Noemi Caponi, UFSC

Using Michel Foucault's lectures on "Psychiatric power" as its starting point, this article analyzes the book *Simulación de la locura* (The simulation of madness), published in 1903 by the Argentine psychiatrist José Ingenieros. Foucault argues that the problem of simulation permeates the entire history of modern psychiatry. After initial analysis of José Ingenieros's references to the question of simulation in the struggle for existence, the issue of simulation in pathological states in general is examined, and lastly the simulation of madness and the problem of degeneration. Ingenieros participates in the epistemological and political struggle that took place between experts-psychiatrists and simulators over the question of truth.

simulation; psychiatry; madness; José Ingeniero ; Michel Foucault (1926-1984)

Qu'est-ce qu'une idéologie médicale?

Tiago Santos Almeida, Universidade de São Paulo

Les concepts d'idéologie scientifique et d'idéologie médicale ne se confondent pas dans l'œuvre de Georges Canguilhem, en dépit de toute apparence : si le premier est un système explicatif ou un discours à prétention scientifique, le dernier trouve sa place dans les formes historiques de médiation entre le savoir médical et la pratique thérapeutique. Si la généalogie du concept d'idéologie scientifique a été clairement décrite dans l'avant-propos du livre de Canguilhem "Idéologie et rationalité dans l'histoire des sciences de la vie" (1977), le manque d'explication similaire concernant l'idéologie médicale a renforcé l'impression de que ce concept pourrait être un cas spécial de l'idéologie scientifique. Pourtant, l'étude sur quelques thèmes de l'École germano-américaine d'histoire de la médecine (notamment Henry Sigerist et Erwin Ackerknecht) permettra de mieux comprendre la portée du concept d'idéologie médicale et la contribution qu'il peut apporter à l'historiographie contemporaine.

Idéologie médicale; Idéologie scientifique; Georges Canguilhem; Henry Sigerist; Erwin Ackerknecht

057. Public Health, Medicine and Migrations: The Control of Populations and Borders in a Historical Perspective in Americas

"Closing doors to Asian people": Immigration, Public Health and migration controls in Colombia, 1880-1930

Ana Milena Rhenals Doria, Universidad Industrial de Santander

Recent research has included the variable of public health as a category for useful analysis in the study of migration policies designed by some Latin American countries. In Colombia, where immigration as an issue has become part of historical studies since 1990, few research projects have connected public health, immigration and mobility of immigrants as variables. In this paper, I address the interconnectedness of these variables by establishing as a point of departure the experience of the Syrian-Lebanese and Afro-Antillean immigrants, who arrived in Colombia between 1880 and 1930. I intend to shed light on the role played by public health in shaping and defining the profile of these immigrants. I will argue that in the cases where the immigrants' skin color did not help authorities to establish their unwanted status, assessments associated with public health (diseases, hygiene) were definitive in supporting the immigration control policies that were applied. These laws, although failed to prevent the arrival of Asian people to Colombia, legitimated a set of derogatory representations about these particular immigrants and reinforced discourses and narratives of superiority and inferiority that had an impact on the articulation of immigrants in Colombian society.

Immigration, colombia, afro-antillean, syrian-lebaneses, public health

Immigration, science and health: risks control and expanding rights in the Rio de la Plata Basin (1873-1911)

Fernanda Rebelo-Pinto, Federal University of Bahia

This paper analyzes how immigration process in the Rio de Plata Basin countries, specifically Brazil and Argentina, promoted inflexions in the sanitations agreements in the end of 19th century. The port is a device within in which are defined knowledge and standards and are established interventions on people in transit, particularly immigrants. The barriers in the agreements between these countries were not only related to controversies within medical and scientific communities but also to political and economics tensions linked to the labor immigrants disputes. In the beginning of 20th century, we can see a shift of interest and issues related to public health: epidemic control was not enough. The states must guarantee some benefits to the populations, especially health care. This new view is analyzed according to the understanding and uses of the liberal ideology concerning risk self-regulations, collectivization of welfare and expanding of civil and social rights. This process is leveraged in parts by the inclusion of the immigrants in theses societies.

Immigration; Diplomacy; Outbreaks; South America; Biopolitics

Le National comme principe et le but: catégories de classification des populations et les politiques de l'immigration et de la colonisation dans les années 1930

Jair de Souza Ramos, Universidade Federal Fluminense

Cette communication vise à examiner comment la catégorie nationale et ses dérivés (nationalisme et de nationalité) ont agi comme les principaux mécanismes de classification des populations qui guident les deux organismes internationaux tels que l'OIT (Bureaux International du Travail), et les lignes directrices du gouvernement Vargas. Nous allons voir que son utilisation implique des continuités et des tensions entre les organismes nationaux et internationaux, et ils servent à marquer les différentes manières de traitement des travailleurs.

l'immigration; la colonisation; la formation de l'État

Image of madness in the late nineteenth and early twentieth centuries: the scientific, socio-cultural and political context of alienated assistance in the conceiving of the agricultural colony in the city of Rio de Janeiro

Jeanine Ribeiro Claper, Casa de Oswaldo Cruz/Fundação Oswaldo Cruz

In the late nineteenth and early twentieth centuries under the international influence of scientific theories and national therapeutic practice, discussions were being waged and therapeutic solutions that were constructed an ideology of institutionalization of madness in the city of Rio de Janeiro. This ideology, which also went through questions as urban organization and the mediation from sensation to feeling, where nature was the source of stimulus for the therapy of the alienated, who conceived the Colonia de Alienados in Jacarepaguá, Rio de Janeiro, now known as Colonia Juliano Moreira. The objective of this work is to analyze the scientific practices of treatment of madness inserted in the ideal of nation passing through the disease, doctors, philanthropists, mental alienation,

delineating the socio-cultural "image" of the madness in the civilizing process in the city. In addition, analyze how the medical intelligentsia, through the thought of the doctor Juliano Moreira and his intellectual circle influenced the social and aesthetic identity of the institution, performing a counterpoint of the Colonia de Alienados in Jacarepaguá with the Colonia Nacional de Alienados "Open Door", in Luján Provincia of Buenos Aires, Argentina, current Colonia Dr. Domingo Cabred. Three axes will be discussed in this paper. The first, the perception of madness and its images, the relationship between morality and feeling. The second, the relationship of madness with the city and its processes of 'modernization' in the early twentieth century. And, finally, the exchange of ideas and the structuring of the medical field, discussing the circulation of knowledge about the agricultural colony model, in a transnational history perspective, between the cities of Rio de Janeiro and Buenos Aires.

Alienate Assistance; Public Health; Colonia Juliano Moreira; Latin America

Concepciones médicas en torno a la degeneración de la raza en Uruguay a comienzos del siglo XX

María José Beltrán Pigni, Universidad de la República (Uruguay)

Elizabeth Ortega Cerchiaro, Universidad de la República

El trabajo describe y analiza una serie de preocupaciones en torno al mejoramiento de la raza en Uruguay a comienzos del siglo XX. Estos debates pueden entenderse como parte de una fuerte inquietud por el destino de la población uruguaya, fundamentalmente en relación a la calidad de la fuerza de trabajo y a los parámetros morales de la convivencia social. En este contexto, se tornaba necesario conocer y gestionar un conjunto de comportamientos considerados anormales o desviados, los cuales en su extremo, llevarían a una degeneración de la raza, vinculados éstos, principalmente, a la locura y el crimen.

Ello habría tenido como soporte una serie de transformaciones en varios ámbitos de la vida social tales como el proceso de modernización de la sociedad uruguaya y la creciente consolidación del saber y poder médico. Así mismo, se crearon mecanismos y formatos institucionales que hicieron posible que la psiquiatría formara parte central de estos debates y que fuese un actor implicado en la creación de dispositivos que atendieron dichas preocupaciones, tales como la Liga de Higiene Mental del Uruguay en 1924.

La teoría moreliana de la degeneración, que dominaba la psiquiatría francesa hacia mediados del siglo XIX, fue uno de los elementos argumentales en el que se basó el saber médico en Uruguay para llevar adelante una serie de discursos y prácticas asociadas al mejoramiento de la raza, algunas de ellas efectivizadas en legislaciones y otros dispositivos y otras que expresaban una preocupación por el destino de la población uruguaya.

En el trabajo se abordará el alcance de las concepciones asociadas a la raza (razas superiores o inferiores, razas evolucionadas o atrasadas, razas europeas o americanas) así como su relación con la noción de especie. Dichas concepciones se analizarán a la luz de las ideas sobre eugenesia que circulaban en Uruguay a comienzos del siglo XX.

Raza, Eugenesia, Degeneración

Syrian migration crisis; a case study for the development of public health policies in Colombia

Maria Manuela Chemás Vélez, Pontificia Universidad Javeriana

The Syrian civil war has had a massive impact on the civilian population generating the exodus of 4.8 million people who have had to take refuge in neighboring countries, in the European Union and even in Latin America. The armed conflict has been characterized by the targeting of civilians, medical personnel and health infrastructure, and as a result the situation in terms of health is bleak. The international medical community has been unable to access Syria due to the hostility of the armed groups and has hence centered its effects on bringing aid to those who have emigrated. Meanwhile Colombia who has historically been considered a generator of migration due to its internal conflict is becoming a country of transit for immigrants from multiple countries of origin that arrive through Colombia's extensive maritime and terrestrial boundaries and look to cross Central America on their way to the United States and Canada. The number of undocumented immigrants is rising exponentially constituting a highly vulnerable population that generates challenges for the public health sector. By reflecting on the situation of the Syrian immigrants, the main health concerns that they face and the different approaches in terms of public health that receptor countries have had, we can review our current national and regional situation and revise our existing public health policies.

Migration; Health; Public Health; Syria; Colombia

Medical-sanitary inspection areas: the Hotel of immigrants in Argentina (ca. 1900-1940)

María Silvia Di Liscia, Universidad Nacional de La Pampa

The immigration of Ultramar was in Argentina a massive phenomenon, that involved millions of people from the end of the XIX century until the middle of the XX. The promotion of the European population, above all, implied the creation of organisms and institutions for the support of those who came to the country and were admitted to Immigration Law, sanctioned in 1876. These were the third class travelers, who came from Ships arriving at the port of Buenos Aires in the first place, or to Bahía Blanca, Rosario and La Plata, in the second place, and that once accepted their entrance, they dispersed by the Argentine territory. But in that process, and since their inclusion was not automatic, sometimes thousands of people who arrived weekly to the country could stay a limited period of time in the facilities of the Hotel de Inmigrantes in Buenos Aires. This space, founded in Buenos Aires at the beginning of the 20th century on the basis of other buildings that had similar functions but were more precarious, had the economic support of the State, through the General Directorate of Immigration.

During the first four decades of the twentieth century, the building of the Immigrant Hotel, equipped theoretically with all the benefits of modernity (four stories, with rooms and kitchen for three thousand people, offices and a hospital, as well as other services), was Planned to provide less-fortunate foreigners with a place to recover from the trip and, in turn, to organize future work activities (for example with a work office), as well as to provide the state with a stage for immigration control (for fingerprints). With the decline of massive immigration from Overseas, the Hotel was gradually abandoned, given the economic and administrative difficulties to support a public building with these characteristics. In this paper, we study the historical background of the Hotel, as a space for the reception of immigrants and considering, above all, the social and health aspects of the complex process of incorporation of the foreign population, as a staged space for the inspection of future citizens Argentines.

Medical Inspection; Argentina; History

058. Public Health: Local Challenges, Global Responses? Debates on 19th and 20th Centuries

Global History and Latin America: Current Debates and Perspectives

Andres Baeza, Pontificia Universidad Católica de Chile

The global turn has been one of the most influential and diffused historiographical innovations of the last decade. However, what is properly “global” in this perspective remains diffuse and does not compel all the regions of the planet in the same way. A clear example is the marginal place of Latin America in recent debates on global history that have taken place in the English speaking world which mainly focus on the European connections with Asia, Africa and Oceania. This is due to the close connection between (British) imperial and global histories, which has unified a wide range of regions that formed part of the British Empire, among which Latin America does not count. Despite this, over the last five years there is an increasing interest in including this region in the debates on global history. This is in part because of the need of overcome the nation-state centered narratives which characterized Latin American historiography in 19th and 20th centuries. This presentation aims to reinforce that need by means of the analysis of recent approaches about global history that might be applied to the study of a wide range of historical processes and phenomena that took place in this region as wells the discussion of other concepts that challenge the validity of global history as an analytical perspective (transnational history and interconnected histories).

Global History, Latin America, Historiography

Nutrition Policy and the Limits of Social Medicine in the Latin America, 1930-1950

Eric D. Carter, Macalester College

The objective of this paper is to explore the place of nutrition in public health policy discourse in Latin America in the 1930s and 1940s. At the end of this period, there was a marked transition towards a more complex international institutional architecture to address nutritional problems. Disconnected national-level policymaking and limited efforts by the League of Nations (and its affiliate, the International Labor Organization) were largely superseded by relatively robust institutions (e.g., the United Nations' World Food Program, the FAO, and WHO). Yet little research has addressed Latin American participation in, and influence on, the genesis of these organizations, or national nutrition policy antecedents in the region. As part of a larger book project on the history of Latin American social medicine, I seek to, first, categorize and explain the discourses on health and nutrition in that era, particularly the ideological orientations of these discourses; second, to understand how nutritional issues were incorporated into the policy domain of social medicine, and related fields such as eugenics, puericulture, and pediatrics; and third, to explore such questions through discourse analysis and the study of life trajectories of major and minor figures in social medicine and nutrition policy of the mid-20th century: Josue de Castro (Brazil), José Maria Bengoa (Venezuela), Pedro Escudero and Juan Maurin Navarro (Argentina), and Eduardo Cruz-Coke and Jorge Mardones Restat (Chile). Preliminarily, I argue that nutritional problems were fundamental to social medicine diagnoses of the root causes of population health conditions, articulated through elaborate political-economic critiques that encompassed national agricultural trade policies and agrarian issues (e.g. land tenure, rural working conditions, and rural labor rights). However, the limited reach of public health beyond biomedical spaces (the research lab, the clinic, the hospital) and urban areas led to the de-socialization of nutritional issues, intensification of scientific research on nutrition and

metabolism, and segregation of the nutrition question from problems of food, agriculture, and development. This epistemological shift coincided with the logic of post-World War II international development architecture.

nutrition; public health; social medicine; Latin America

The emergence of School Health: Medical and Educational discourses and policies in Chile between wars (1920-1940)

Josefina Cabrera, Pontificia Universidad Católica de Chile

Since XIX century, the school was seen as an efficient instrument to prevent and take care of health. This explains the convergences and alliances between educators and physicians. In this presentation, the discourses and policies that had repercussions in the construction of a new model of a citizen will be analyzed during the decade 1930-1940 in Chile. For this analysis, the international ties are key. It is the circulation of these ideas which is a characteristic of great relevance of this period. Within this context, eugenics became an ample interdisciplinary project, with which the international scientific community was committed and whose objective was the improvement/progress of humanity. As I will try to demonstrate, the inclusion of the sciences in the construction of the individual created important debates and reflections which came forth from the person towards society. In turn, the questioning about how to solve the problems which the population suffered strengthened the role of the state in these areas, which generated policies that searched for such ambitious goals as improving the race at the school.

school health; education; policies

A new tuberculosis? Society, health policies and globalization in Chile. 1973-2008

Marcelo López Campillay, Pontificia Universidad Católica de Chile

One of the iconic epidemics of the 20th century in Chile, tuberculosis is a privileged forum to examine the evolution of the historical link between society and Koch's bacillus in recent decades. Although tuberculosis began to decline systematically as a public health problem in Chile in the 1960s and 1970s, largely due to the action of a second generation tuberculosis policy, the disease has maintained a Historical singularity that has been projected at the dawn of the 21st century. This assertion is based on the recognition of a series of circumstances that began to converge in Chile since the 1990s and which motivate us to examine the tuberculosis reality in a scenario formed by some interactions that have been generated between some local factors and Global tensions between the traditional public health model and the neoliberal economic policies of democratic governments; The transformation of the country into an economic pole that encouraged the migration of people from some countries where tuberculosis is still a relevant epidemiological problem; The emergence of co-epidemics that have integrated tuberculosis and HIV / AIDS; And the validity of a vertical health policy represented by the tuberculosis control program in a context where some public and private agents promote horizontal relations between population and medicine. In light of these antecedents, we believe it pertinent to propose some questions. To what extent has second-generation Chilean anti-tuberculosis policy been determined by processes of a global order such as migration, human rights or neoliberal approaches in the area of health ? Is it feasible to speak of a new tuberculosis in the light of the sociocultural, political and epidemiological context in which it is

inserted today? On these fundamental questions we will try to modulate some answers that will lead us to explain the possible articulations between the antituberculous reality and a globalized scenario.

Tuberculosis, Global Health, Health Policies

Drug advertising market and public health policies: a case study based on the *Revista del Circulo Médico de Córdoba* and the *Revista Médica de Córdoba*, Argentina, (1912-1952)

María Dolores, CIECS- CONICET y UNC

Adrián Carbonetti, CIECS- CONICET y UNC

María Laura Rodríguez, CIECS- CONICET y UNC

In the present work we propose to examine the conformation and consolidation of an advertising market of medicines directed to a specialized public. We try to address the rhythms and features of these constitutive and affirmative processes by recovering a set of variables that would be closely linked with them, namely; the stage of professionalization achieved by the local medical community, an axis which, we believe, would determine a particular editorial path of the publication under study; the economic policy linked to national industrial development, more specifically that relating to the pharmaceutical industry. In a convergent way, we questioned the imbrication between the advertising dynamics and the development of a legislative framework tending to regulate the production and distribution of medicines. We put this last question in the center of the analytic scene, considering that advertising - as strategic devices - and the market of offers that is configured, are part of a changing and specific trajectory where the local, the national and even the international are articulated in a way Particular by introducing legislation to regulate the activities of the pharmaceutical sector.

The research proposal is anchored in a qualitative hermeneutical analysis of a set of drug advertisements placed in the *Revista del Circulo Médico de Córdoba* and in its successor, *Revista Médica de Córdoba* between 1912 and 1952. The temporal cut corresponds, respectively, to the year of circulation of the publication and the cessation of a political stage that would mark a series of ruptures in public health and, with them, would bring a series of mutations in the area of the pharmaceutical industry.

medicines; public health policies; journals; Cordoba

Homeopathic Cabinets & Sugar Globules The Circulation of Homeopathic Therapies from the US to Peru (1880-1915)

Patricia Palma, University of California, Davis

Homeopathy has a long-standing tradition in Latin America. It has distinguished patients, such as the Argentine General José de San Martín and Mexican President Porfirio Díaz, which have made the use and practice of this medical knowledge more visible in the field of public health in Latin America. In Peru, this healing system arrived in 1880s with the American homeopath George [Jorge] Deacon who challenged the powerful School of Medicine to accept this unorthodox healing system, and popularized this medical knowledge, which produced passionate debates between sympathizers and detractors of this system.

Although 19th century Limeños did not extensively use homeopathy, their patients –most of them middle and upper class– played a decisive role moving the debate to the public sphere. This

presentation examines the circulation of homeopathy and its remedies (Cabinets & Sugar Globules) from the US to Peru in a moment where Lima's School of Medicine sought to eradicate medical quackery or healing systems practiced by unlicensed practitioners. My approach focuses on the circulation of medical knowledge and seeks to demonstrate that Peruvian public health was an arena of tension and dispute between different healing systems, and despite the discourse of the medical elite, allopathic doctors were far from having a monopoly on public health.

Homeopathy; Peru; circulation of medical knowledge

Local diffusion of a global practice: The smallpox vaccination in Chile, 1805-1830

Paula Caffarena, Universidad Finis Terrae

This presentation aims to analyze the diffusion of smallpox vaccination from 1780 to 1830 as part of a global process of which Europe, Asia, Africa and Oceania were also part, albeit with different rhythms. We are interested in establishing comparative frameworks with other territories of Hispanic America and the European world, which, almost parallel to the Chilean case, also began to spread the smallpox vaccine. Vaccination, as a public health policy, despite the economic, political and social changes of the period, remained a major concern of the authorities. They assumed that the protection of citizen's health was one of their duties and designed mechanisms to carry it out. I conclude that the spread of the vaccine in early nineteenth century was the first attempt to implement a medical program that aimed to improve the population's health by preventing rather than curing a disease or fighting an epidemic.

Public Health, Vaccination, Smallpox, Global History

059. History of Tropical and Neglected Diseases from the 19th to the 21st Centuries

Combating Kala-azar: Indian Experience and Experiments

Achintya Kumar Dutta, The University of Burdwan, India

Kala-azar became a major health problem in British India. Despite the discovery of effective drugs and their successful use in kala-azar cases, the disease could not be eradicated. But amazingly even after 68 years of India's independence from British rule, kala-azar is still prevalent in India, posing serious threat to her people. Although the disease had nearly disappeared in India by the mid-1960s, an epidemic resurgence of kala-azar in 1976–77 affected hundreds of thousands of people. Kala-azar transmission continues thereafter. Currently India is one of the key endemic countries and a big share holder of the world's kala-azar burden.

Despite the efforts taken by the Government of India, National Institute of Communicable Diseases, Delhi and World Health Organization, kala-azar could not be prevented and the goal of its elimination from India by 2010 and again by 2015 was lost.

However, in the absence of organized and integrated approach, this disease remained widely prevalent in eastern India. Kala-azar is still causing concern to the Indians. Poorly organized disease surveillance and vector control activities, limited access of the victims to health care facilities, shortage of equipped health centres and effective drugs, the widespread circulation of spurious drugs, allocation of meagre funds for its prevention and eradication, and ignorance of the true prevalence of the disease and underestimation of human sufferings are some of the major factors that stand in the way of effective control and prevention of the disease. More importantly, the lack

of determination and good will may be said to have been the root cause of the failure. Indian bureaucrats and administrators are also culpable, by refusing to give priority to tackling the kala-azar problem. The available evidence shows that the disease mostly affects the poorest and most disadvantaged sections of society, living in rural areas. This ought to stoke more – rather than less – concerted action.

The proposed paper, based primarily on the primary sources, may be useful to supplement the general findings by medical studies on the disease control programme and enrich the literature in medical history. It may influence the understanding of the ins and outs that the disease control and eradication programme needs to be in a better shape within the health care policy.

Kala-azar, India, prevention, eradication

The Ecology of tsetse fly in the Portuguese context: the contribution of António de Barros Machado (1912-2002) in the second half of the 20th century

Ana Rita Merelo Lobo, CIUHCT - Universidade NOVA de Lisboa

Maria Teresa Novo, Global Health and Tropical Medicine (GHTM), UEI Parasitologia

This work is centred on the scientific contribution of António de Barros Machado to tsetse fly (*Glossina*) taxonomy and intends to consider the impact of his publications to the history of medical entomology, of African trypanosomiasis and, in last instance, of tropical medicine. The fundamental aim is to discuss how his legacy can or cannot be incorporated into a more comprehensive narrative which analyses the function of medical entomology in the evolution of vector control methods for which taxonomy has a prominent role in the second half of the 20th century.

António de Barros Machado was a Portuguese zoologist graduated by University of Porto who was exonerated from teaching in 1934, for political reasons, and who settled down in Angola, working with Diamang. Here, as director of the Laboratory of Biological Research of the Museum of Dundo, he developed several researches within his scientific background, with particular emphasis to the history of biology of tsetse fly. He was the author of the taxonomic revision of the Genus *Glossina*, publishing several scientific work about the Groups *Palpalis* (1954), *Fusca* (1959) and *Morsitans* (1970). These publications and taxonomical revisions are referred by international authors, namely JP Glasgow (1970), John Ford (1970, 1971) and AC Pont (1980).

As methodology we will use Machado bibliography, as well as all national and international literature on the ecology of *Glossina* and its importance to the control of trypanosomiasis in Africa, towards a bidirectional analysis between an environmental history and the history of public health where hosts and vectors are related, to discuss the history of trypanosomiasis in the second half of the 20th century.

Glossina; trypanosomiasis; history medical entomology; history tropical medicine

Disease, water and ecology in the tropics: the schistosomiasis during the Brazilian development Era (1950-1985)

André Felipe Cândido da Silva, Casa de Oswaldo Cruz - FIOCRUZ

Dominichi Miranda de Sá, Casa de Oswaldo Cruz - FIOCRUZ

The studies on schistosomiasis and policies against it became more systematic in Brazil since the 1950s, time considered the apex of the Era of Development. This moment was shaped by the faith in the ability of science and technology to alleviate poverty in its causes and consequences. Few diseases represent so well the development initiatives and its impact such as schistosomiasis,

closely linked to the interventions and uses of fresh water collections by the human societies. Our aim is to analyze the studies and control approaches carried out by a group of Brazilian researchers on schistosomiasis from the 1950s, when the disease gained relief in the national and international scientific and public health agenda, to 1985, when the civil-military dictatorship established in 1964 came to an end. We intend to highlight those approaches that applied a more integrated and broader perspective, involving the relations of the snail hosts with the environmental factors, but that also focused the complex interactions among biological, social, economical and cultural factors related to the infection. We show how the interventions in hydric regimes by the works impelled by development policies and the uses of water by local populations were acknowledged as relevant elements to the disease occurrence, at the same time that the migration of populations from the Northeast region was also considered fundamental to the disease spread. We discuss the dialogue between the actors that dedicated themselves to study and control schistosomiasis with the ecology, at a time when it was structuring itself as a institutionalized discipline. This ecological aspect of biomedical research aimed at complexifying the reductionist model focused on controlling the disease with chemical products against the snail host or with medicines for the parasite's death inside patient bodies. Through the study of schistosomiasis we try to understand how politics, science, health and natural resources, especially water resources, were articulated in development projects formulated, debated and implemented in Brazil during the second half of the twentieth century.

schistosomiasis, development projects, tropical medicine, health and ecology

The local and the global framing a biomedical research agenda: The recollections of scientists from the Institute of Biological Sciences of the Federal University of Minas Gerais (ICB/UFMG)

Anny Jackeline Torres Silveira, Universidade Federal de Minas Gerais
Rita de Cassia Marques, Universidade Federal de Minas Gerais

The development of the biological sciences in Brazil during the 20th century was heavily affected by the establishment of an agenda aimed at solving public health issues – with emphasis on endemic/epidemic diseases – involving scientists, Brazilian public authorities and international agencies. An example is the role performed by the Rockefeller Foundation in the history of biomedical sciences in the state of Minas Gerais. The first incursion of the Rockefeller Foundation in Minas dates back to 1916, with the participation of a commission responsible for the study of and for the battle against ancylostomiasis in the area of Capela Nova de Betim. In the following years, this collaboration unfolded on other fronts, such as the agreement reached with the Hygiene Board of Directors of Minas Gerais to implement a Rural Prophylaxis program (anchored in the installation of health centers oriented at the diffusion of hygiene precepts and the fight against local endemics), the financing of scientific exchange programs (with the sponsorship of study missions in American institutions for researchers from Minas Gerais), as well as the funding for the installation of laboratories and the library of Belo Horizonte's School of Medicine. The support and influence of that agency in the consolidation of areas such as biochemistry, physiology, anatomy, immunology and others, lasted the following decades, being reflected in the creation and establishment of the Institute of Biological Sciences of the Federal University of Minas Gerais (ICB/UFMG) in the end of the 1960's, as well as in the structuring and consolidation of areas/research themes in the same institute – such as trypanosomiasis, leishmaniasis, schistosomiasis or the venoms of poisonous animals. This presentation focuses on a network of exchanges involving international philanthropy, Brazilian institutions/researchers and endemic diseases, by means of the oral testimonies of researchers – that are being produced in the scope of the “Scientific history of ICB” project – discussing how the

ICHST
2017

scientific agenda developed by this institute reflects, at the same time, the demands of the local scientific community and international interests.

biomedical research; Rockefeller Foundation; ICB/UFMG; endemic diseases

Was Cancer a Disease of Civilization?

Bado Jean Paul, university of Aix-Marseille

Even if the last decades of the Nineteenth century marked the period of many medical discoveries of the germs and the vectors of diseases, the problem of cancer was new in colonial Africa on account of the particularities of this disease. Hippocrates followed by Galen have founded their analysis of this disease on the theory of tumors. What Bennet, Virchow and others physicians discovered changed the perception of cancer. But, in colonial Africa, there was problem due to the racial theory which prevented a lot colonial physicians to declare that Black people living in "primitive life" were not victims of cancer because this ailment was a disease of civilization. Otherwise a disease linked to European style of life, and life expectancy.

By studying this disease during colonial period, I wonder to understand more the reasons and the consequences of this perception of cancer, not only in Africa but also elsewhere. How a disease could become a hostage of vision of others, more directly, of the prejudices when the specialists of biomedicine considered cancer as disease of cells by knowing that Africans are human being like others people who live far from what they call civilization? Behind this question, there is another relating to what we call the "objectivity of biomedicine" in its contact with other people different from Europeans? This problematic is essential to understand more our cultural perception of disease often obstructed by "scientific vision" of maladies in Africa.

Cancer, Africa, Colonization, Civilization

Doctors in extreme times: practices and medical and surgical knowledge in the Paraguay War and the Franco-Prussian War (1864-1870)

Carlos Leonardo Bahiense da Silva, Casa de Oswaldo Cruz/COC-FIOCRUZ

The Paraguayan War (1864-1870) - also called the Triple Alliance War - began because of the expansionism of the Paraguayan dictator Francisco Solano López in South America, especially in the Platina Basin. The conflagration fatally victimized about 300,000 individuals. The Franco-Prussian War (1870-1871) integrated the process of formation of the German national state. The geopolitical advance of the Hohenzollern, leading to the formation of the German Confederation of the North, became unacceptable to the French leader Napoleon III, who reacted with dismay. The conflict generated approximately 140,000 deaths.

In both conflagrations the combatants died more due to the diseases - smallpox, cholera, tuberculosis - than of the battles. Another problem was the incidence of cases of emotional ruptures - shellshock - among combatants. The challenge for the doctors of the time, was to identify the "pretenders" of those who truly suffered serious psychological changes. The Herculean task of doctors did not stop there. Several soldiers were also injured in combat. Surgical interventions on a large scale required expertise and resources of doctors then - elements not always exist.

Based on the considerations made up to this point, we will try to understand Brazilian medicine in the Paraguayan War, with reference to the knowledge and medical practices adopted during the Franco-Prussian War. The analysis will pay special attention to "war neurology". In line with

homonymous work, organized by L. Tatu, the term neurology is thought in the broad sense, involves three areas: neurosurgery, neurology and psychiatry. The documentary corpus is based on two texts: Medical-surgical history of the Brazilian police station in the Uruguayan and Paraguayan campaigns of Dr. Carlos Frederico dos Santos Xavier Azevedo and *Traumatische, Idiopathische und nach Infektionskrankheiten Beobachtete Erkrankungen des Nervensystems - Bei den Deutschen Heeren im Kriege Gegen Frankreich 1870-1871* (anonymous).

Keywords: military surgery; shellshock; cholera; War of Paraguay; Franco-Prussian War

American Tegumentary Leishmaniasis – History, political and research network in the Amazon (1970-2015)

Claudio de Oliveira Peixoto, Fiocruz - Instituto Leonidas e Maria Deane

Leishmaniasis represent a health and scientific problem of extreme importance in the Amazon. This paper examines how economic processes and environmental and political elapsed since the 1970s contributed to leishmaniasis, especially the American Tegumentary Leishmaniasis (ATL), were to acquire the epidemiological importance and medical and health they have today in the Amazon. Correlates the data on the disease with various processes: the dynamics of land occupation and urbanization in the state; border security; the effects of the Manaus Free Trade Zone in the industrialization process and actions aimed at regional development; human migrations and projects implemented in the name of national integration policy of the federal government. Based on analysis of documents and oral history, communication seeks to show how leishmaniasis acquired increasingly important place on the appointment book of health institutions and national and foreign researchers interested in the study of local wildlife of *Leishmania*, their vectors and hosts, the clinical and epidemiological characterization of the disease, as well as in their treatment. It aims to contribute to the social history of leishmaniasis by analyzing the interactions that occur between research and public health institutions Amazon with institutions from other states or countries concerned with the issue. Investigates the circulation practices and knowledge, medical and health activities taking aim leishmaniosis and implementation of policies both in public health and in science and technology. The communication seeks to describe the dynamics of research networks and their relationship to public health actions in order to understand to what extent the production of knowledge is translated into effective measures leishmaniasis control in the state of Amazonas.

American Tegumentary Leishmaniasis; History of Leishmaniasis; Public Health; Health Public Policy; Research Networks in Health

Sleeping Sickness Epidemics and Colonial Responses in Africa, 1900-1940

Daniel R. Headrick, Roosevelt University

In the early twentieth century, Africa was afflicted by epidemics of sleeping sickness caused by the plasmodium *Trypanosome gambiense* and transmitted by tsetse flies that lived on riverbanks and lake shores, and by *T. rhodesiense* transmitted by tsetse flies that lived in grasslands. The colonial governments reacted quickly to this epidemic. Europeans justified their conquests in part as saving Africans from the diseases that plagued them. Furthermore, Europeans depended on African porters, canoeists, and laborers, and declining populations threatened the economies of the colonial territories. To Western microbiologists who had achieved remarkable breakthroughs against so many bacterial diseases, sleeping sickness was an exciting challenge.

In response to the epidemics, European colonial governments sent scientific missions to Africa to study the disease. Scientists were able to identify the plasmodium that caused the disease, the vectors and their modes of transmission, and the environments in which they proliferated. Scientists and colonial administrators tried three different methods of combating the disease. An environmental method consisted of removing Africans from areas known to harbor tsetse flies. A second method was medical, namely injecting the sick with drugs to kill the plasmodia, thereby preventing the flies from transmitting the disease to healthy people. And a third method consisted of isolating sick Africans in special camps further from healthy people than tsetse flies could travel. The European nations with colonies in East and Central Africa all adopted variations on these three methods. Yet the mix of methods varied from one colony to another.

The British administrators' favored method was environmental, namely removing Africans from the shores of Lake Victoria and setting fire to the bush in areas known to harbor tsetse flies.

In the Congo, the Belgians instituted strict public health measures. They controlled the movement of people and established camps for the sick. Later, they also built rural clinics.

In the French colonies, a doctor created mobile medical teams that went from village to village, injecting the sick with atoxyl, a drug that killed most trypanosomes and some patients as well.

The Portuguese implemented all three methods. However, unable to afford these costly methods in all their colonies, they limited their efforts to the small island of Principe.

sleeping sickness; colonialism; Africa

Between Latin America and Europe: leishmaniasis, tropical medicine and scientific controversies

Denis Guedes Jogas Junior, Casa de Oswaldo Cruz- Fiocruz

This paper deals with investigations conducted globally on leishmaniasis in the first half of the twentieth century. This group of diseases was created through conceptual reframing provided by new medical paradigms - microbiology and tropical medicine - in the first decade of the XXth century. Knowledge circulation processes and cleavages produced among researchers from different regions of the globe sharing the common goal of systematizing knowledge about leishmaniasis took place at the same time as tropical medicine was institutionalized as a medical speciality with institutions, concepts and spaces of its own in different countries or colonial spaces. Researchers and institutions from Latin America played a fundamental role in forging the category of American leishmaniasis as a new and differentiated manifestation of leishmaniasis with a predilection for the mucosal areas of the body and a much more extensive and aggressive clinical course when compared to the Oriental button found in European colonies in Asia and Africa. Incaic huacos (ceramics) found in Andean regions showing supposed mutilations caused by leishmaniasis gave substantial arguments for doctors involved in the investigation of this group of diseases and interested in defending the existence of a pre-Columbian and autochthonous form of leishmaniasis in Latin America. However, this theory caused strong scientific controversies as I intend to show in my presentation.

leishmaniasis; tropical medicine; scientific controversies

From the “first contact” to the “silent era”: The *Anopheles gambiae* mosquito in Brazil (1930-1938)

Gabriel Lopes, Casa de Oswaldo Cruz

The research presented in this paper intends to reflect on the arrival of the *Anopheles gambiae* mosquito in Brazil, the role of the Rockefeller Foundation (RF) International Health Division (IHD) in the discovery and identification of the *A. gambiae* in Natal-RN (1930) and the first local and national efforts to deal with malaria outbreaks caused by this mosquito. My research is following, in general, the intertwining between the history of entomological medicine and transnational history concerning public health. The history of the *A. gambiae* in Brazil can be divided in three phases, the first one goes from its arrival, followed by the first two malaria outbreaks in Natal, until its eradication in this city (Capital of Rio Grande do Norte State) in a emergencial local operation leaded by the CYFS (1930-1932), the second is called the “silent era”, when this mosquito spreaded on the Northeast region of Brazil - reaching better-watered areas in the Rio Grande do Norte State and into the Ceará State (1932-1937). The last phase starts with the rainy season of 1938 that lead to a big malaria outbreak and the creation of the MSNE - cooperation service that and eradicated the *A. gambiae* from Brazil in 1940. The study about the first two phases can give important information about how this mosquito that came from Dakar (Capital City of Senegal) to Natal and became a central chapter in the history of entomological medicine with its successful eradication in Brazil. The research dedicated to the history of the entomological and epidemiological work of IHD in Brazil, concerning the *A. gambiae*, before and during the campaign of the Malaria Service of the Northeast (MSNE), needs to get more attention. This paper will explore the first historical sources about how the public health leaders, researchers and the local population reacted to the presence of the *A. gambiae* in Brazil, a special attention will be given to the research and first reports made by Dr. Raymond Corbett Shannon (1894-1945) from the RF IHD, an important character in the history of medical entomology that discovered this mosquito in Natal.

malaria; Rockefeller Foundation; international health; Brazil; Anopheles gambiae

From the doctor's office to the laboratory: the history of Leishmaniasis in Portugal during the XXth century

Isabel Amaral, Faculdade de Ciências, Universidade Nova de Lisboa

Isabel Amaral, CIUHCT, FCT/UNL

Lenea Campino, GHTM, IHMT/UNL

This paper aims at reflecting on the history of human Leishmaniasis, in Portugal, in the 20th century, highlighting the role of the Portuguese medical community in constructing the biomedical narrative around vectors and hosts involved at the Cutaneous and Visceral Leishmaniasis, the two prevalent forms of infection in the European and the Mediterranean context.

From the clinical point of view, and accordingly with the WHO classification of the disease, Portugal has always presented rare cases of cutaneous Leishmaniasis (since the disease naturally recedes most of the times; when treated shows indelible signs; and, not all cases have been reported by doctors), but since 1951 Kala-azar (Human Visceral Leishmaniasis) became a notifiable disease by health authorities. Since 2008, Portugal has a National Leishmaniasis Observatory, based in the Institute of Hygiene and Tropical Medicine, with the central objective of creating and maintaining an epidemiological research network of the human and canine forms of disease, showing evidence of a valuable endemicity pattern at the global scale.

We will focus this historical research on the crucial moments for the history of the disease, within a broader perspective of the Portuguese history of tropical medicine, namely those related to the

clinical identification of the disease, the identification and characterization of its vectors and hosts, and the epidemiological cartography of the disease in the country.

As methodology, not only scientific publications of the researchers from the Portuguese school of tropical medicine will be consulted, but also the reports of the study missions to the Portuguese colonies, the clinical reports published in the medical press by the resident medical community in public hospitals, and the reports published in generalist press, in key moments of the history of the disease in Portugal, which includes the colonial space until the 1960-70s.

Although starting from a European framing of the disease, with this reflexion we will try to contribute to a broader discussion of the history of Leishmaniasis at the global scale. It is therefore intended to make connections with the history of tropical medicine of the 1900s, making it possible future comparative studies with a focus on the networks of knowledge and practices circulation and appropriation in the Americas, Africa, Europe and Asia, drawn at the confluence of the narratives between the Old and the New World.

Leishmaniasis, Kala-azar, leishmania infantum, Observatório Nacional da Leishmaniose, Portugal history tropical medicine XXth century

Brazil and leishmaniasis, diseases from the tropics that became a global risk: a historical contribution

Jaime Larry Benchimol, Fundação Oswaldo Cruz

The first cases of cutaneous and mucocutaneous leishmaniasis in the Americas were described in São Paulo in 1909; only in 1934, a pathologist of the Yellow Fever Service found in Brazil visceral leishmaniasis (kala azar). These axes began to intertwine after two events. The Commission for the Study of Leishmaniasis created in 1939 by São Paulo's Health Department resulted in an important book by two parasitologists, Samuel Barnsley Pessoa and Mauro Barretto (1944) on American Tegumentary Leishmaniasis. On the other hand, the Commission for Studies on American Visceral Leishmaniasis headed by Evandro Chagas, from Oswaldo Cruz Institute, gave rise to the Institute of Experimental Pathology for the North and the Service for the Study of Large Endemic Diseases (1937). This was the embryo for the National Department for Rural Endemic Diseases, created in 1956 when national developmentalism was embraced by an important group of sanitarians and an influential fraction of the Brazil's political forces.

Leishmanioses gained increasing relevance among rural endemic diseases and control measures against hosts (dogs) and vectors (Phlebotomine sand flies), in this case through DDT, took place in the shadow of the hegemonic malaria campaign. Large undertakings in Brazil's hinterland after the 1964 military coup transformed leishmaniasis in a serious problem in the Amazon region also. Globally leishmaniasis re-emerged in rural and urban zones and in areas considered free from this endemo-epidemic disease complex due to environmental changes, migrations, economic processes, chaotic urban growth and interiorization.

Since then an increase can be seen in international cooperation regarding the study of causal agents, vectors and hosts, diagnostic technics, therapeutic agents and vaccines. Emphasis will be given to the work done in Brazil by some foreign scientists in the 1960's e 1970's: Ralph Lainson and Jeffrey Shaw in Evandro Chagas Institute produced remarkable contributions to the understanding of Leishmania, its vectors and vertebrate hosts. Philip Marsden in Brasília University became an authority in the control of leishmaniasis. Important work was done by Toby Barret and Jorge Arias in the National Institute for Amazonian Research, and by Heinz Muhlpfordt in Oswaldo Cruz Foundation, at a time when rural endemic diseases began to be refocused by molecular biology.

History of leishmaniasis in Brazil; American Tegumentary Leishmaniasis; American Visceral Leishmaniasis; Neglected Tropical Diseases; History of tropical medicine in Brazil

Bad Health in a Good Retreat: Life and Death in the “Worst” Neighborhood of São Paulo, Brazil

Jeffrey Lesser, Emory University/IEA-USP

Bom Retiro was (and is) a small neighborhood in the huge megalopolis of São Paulo, Brazil. Filled with small factories and warehouses, the working class neighborhood has been populated since the end of the nineteenth century by immigrants, migrants from the impoverished Brazilian northeast, and Afro-Brazilian descendants of slaves. While the cultural backgrounds of the immigrants have shifted (from Italians, Spaniards and Portuguese Catholics in the early 20th century to East European Jews in the mid twentieth century to Chinese, Korean and Bolivian immigrants today), the neighborhood has always been viewed internally and externally as one where health (in the broadest sense of the word) is precarious.

“Bad Health in a Good Retreat” analyzes the public’s health by focusing on one square block of lower Bom Retiro from about 1900 to the present. My data, from a number of different types of sources, will allow me to analyze everything from the stories residents tell about how to avoid water borne diseases to state imposed campaigns of social control against everything from crime to dengue. The project takes advantage of new digital methodologies that allow me to map the public’s health and how that same public has thought about health over time. My paper will focus on the methodological aspects of the project including oral history, archival research and the aforementioned digital humanities.

History; Methodology; Ethnicity; Health

Tropical Medicine and Circulation of Knowledge: Fraga de Azevedo between Portugal and Brazil (1963-1971)

João Filipe Lourenço Monteiro, CIUHCT

In the present work, carried out within the scope of the project "Medical Network Knowledge: the Institute of Tropical Medicine among institutions, actors, diseases and pathogens", it is intended to reason the meaning of the trips made to Brazil, in the 1960s and 1970s, by João Fraga de Azevedo (1906-1977), doctor of the Tropical Medicine Institute, in Lisbon, in the field of tropical medicine. From the lectures given by Fraga de Azevedo, in Bahia, in 1963 and the course of immunofluorescence taught in 1971, in Rio de Janeiro, we will try to reason the process of circulation of knowledge between the sides of the Atlantic, with the actors involved and the trajectories covered.

As a methodology for this research, we proceeded to the analysis of bibliographic sources available as specialized journals, as well as the medical press clippings of the time and the documentation in the Historical-Diplomatic Archive of the Ministry of Foreign Affairs. The results obtained will be interpreted on the basis of a comprehensive conceptual framework on the circulation of scientific knowledge, with emphasis on the concepts of transfer and exchange, reception and appropriation, go-betweens and contact zone.

The results of this research seem to demonstrate that the work developed by Fraga de Azevedo, in Portugal, had gained international recognition, being illustrated in two occasions which we explore in this work. Firstly, he was invited by the Director of the Portuguese Reading Office of Bahia and the University of Brazil to hold lectures and conferences related to Portuguese scientific research in the field of tropical medicine, which was highlighted in the national and international press. In the following decade, he would return to Brazil at the invitation of the Society of Clinical Pathology of Guanabara to teach an immunofluorescence course, with the support of his assistant Palmira Coelho

Rombert, for being considered by its members a "world authority" in that technique. Using fluorescent dyes, it became possible to observe the antigen-antibody binding under the microscope, which allowed the diagnosis and study of several diseases such as malaria, trypanosomiasis and hookworm infections.

History of Tropical Medicine; Fraga de Azevedo; Circulation of Knowledge; Society of Clinical Pathology of Guanabara; Federal University of Rio de Janeiro

Bibliometric analysis on the history of Leishmaniasis

Juliana Gonçalves Reis, Escola Nacional de Saúde Pública Sérgio Arouca/ Fiocruz
Jaime Larry Benchimol, Casa de Oswaldo Cruz/Fiocruz

This bibliometric study aims to identify and characterize historical articles on leishmaniasis in the PubMed, Web of Science and Scopus bibliographic databases. The search strategy was composed by descriptors of the controlled vocabulary Medical Subject Headings (MeSH), by boolean operators and truncation symbols according to the search term: "leishmaniasis" OR leish* OR "leishmaniasis" AND "19th Century History" OR "20th Century History" OR "21st Century History" OR "Ancient" OR "Historical Article". The criteria for inclusion in this study were articles on the history of leishmaniasis and on scientists who studied leishmaniasis. We excluded articles that, despite the descriptors used, dealt with the clinical, preventive or therapeutic of the disease, or its agents, vectors and hosts. The search was carried out in October 2016, without temporal cut. More than 500 documents have been identified in the databases. After the exclusion of duplicates and those that did not meet the inclusion criteria, 120 documents with a historical approach were left in the composition of the research corpus. The analysis was based on the bibliographic elements and a preliminary categorization, which distinguishes: historical-epidemiological; History of parasitology; Historiographics proper; Studies on leishmaniasis in different regions; entomology; Classification of the disease and its parasites; Pre-Columbian or remote origins of the disease and Leishmania species; International health with some historical perspective; Vaccines and therapies, with historical and prospective balance sheets.

Leishmaniasis; Historical article; Neglected diseases; Bibliometrics

Colloquies and interchanges with Brazilian physicians. Emilio Brumpt and his collaborative and controversy networks in Brazil. (1910-1950)

Maria Gabriela Silva Martins da Cunha Marinho, Universidade Federal do ABC (UFABC)

The purpose of this communication is to analyze the network of collaboration and controversies established by the French Parasitologist Emile Brumpt with Brazilian physicians at home and abroad. Records indicate that the exchanges organized since the 1910s and was extended the following year, involving different groups of Brazilian doctors in São Paulo, Rio de Janeiro and Bahia, but also in Germany. In 1913, Emile Brumpt was hired for Medical Natural History chair the newly created Faculty of Medicine of São Paulo, with the goal not only to teach but also to deploy a parasitology laboratory. Having been assistant Rafael Blanchard in Paris, Brumpt was in Sao Paulo for only one year. With the outbreak of World War I, he returned to France in 1914 where integrate the medical services of the French army. Despite the short stay in the country in subsequent years Brumpt continue maintaining frequent contact with Brazilian doctors inside and outside the country. On a visit to Brazil in the next decade, he was in Rio de Janeiro and Sao Paulo for conferences and tributes.

In addition to São Paulo, where he developed works with Alexandrian Pedroso around leishmaniasis, throughout the 1920s, Brumpt established partnerships with Carlos Chagas in the Committee on Malaria, established in Europe by the Health Committee of the League of Nations, the context in which he worked also the Rockefeller Foundation. However, even before these dialogues, Emile Brumpt had recognized the work of Manuel Augusto da Silva Pirajá, quoted in the first edition of his *Precis of Parasitologie*, who established dialogues in subsequent periods. Finally, in the late 1910s, Brumpt be involved in a feud with Rocha Lima, then housed in Tropeninstitut in Hamburg.

Emilio Brumpt and Brazil; Emilio Brumpt, collaboration and controversy with Brazilian's physicians; Emile Brumpt, Tropical Medicine and collaborative networks

Philanthropy and African Yellow Fever in the Age of Empire

Michael A. Osborne, Oregon State University

The disease yellow fever has had a long interaction with humanity. Though not as yet a global disease, its range has been extensive and scientific and historical study of it has been intensive in both hemispheres. This paper examines the micro-world of yellow fever virology and vaccinology in Africa during the interwar period of the twentieth century. It signals and assess challenges to international cooperation, competition, and even geo-politics in matters of health. This research draws on the archival records of the Northern Hemisphere's three major private institutions engaged in public health and yellow fever activities; the Rockefeller Fund of New York (USA), the Pasteur Institute (France), and the Wellcome Foundation (UK).

yellow fever, Africa, global health

Connections between Psychiatry, Bacteriology, and Tropical Medicine in the Brazilian-German Scientific Exchange (1900-1933)

Pedro Felipe Neves de Muñoz, Pontifícia Universidade Católica do Rio de Janeiro (PUC-Rio)

This paper is part of my PhD research findings and it aims to analyze the relations between psychiatry, bacteriology, and tropical medicine throughout the history of the Brazilian-German scientific exchange from 1900 to 1933. In the psychiatry, these relations begin at the end of the 19th century, when Dr. Juliano Moreira (1873-1933) went to study in Europe between 1899 and 1900 and met renowned German physicians like Paul Flechsig (1847-1929), Emil Kraepelin (1856-1933), and Eduard Hitzig (1838-1907).

A few years later, Moreira advanced in his career when he was called to be the director of the National Asylum in Rio de Janeiro, a position he worked in between 1903 and 1930. In his new role, Moreira established partnerships with the physicians Afrânio Peixoto (1876-1947), Ulysses Vianna (1880-1935), and Antonio Austregésilo (1876-1960) to reform Brazilian psychiatry, mainly through Kraepelin's ideas. In this process, Moreira made some connections between psychiatry, bacteriology and tropical medicine. The first step was to state the importance of building laboratories in all psychiatric hospitals and thus achieve similar goals like Robert Koch (1843-1910) in bacteriology. The second step was to establish an approximation between the National Asylum and the Serum Therapeutic Institute (today Oswaldo Cruz Institute) through collaboration between Ulysses Vianna and Arthur Moses (1886-1967). In 1913 Moreira travelled to Gand in Belgium to participate at the International Congress, when he presented a paper about the nervous forms of the Chagas Disease. After the First World War, the Brazilian and German medicine network became more intensive and

many German physicians came to Brazil, while the Brazilian physicians continued travelling to Germany as well. Some works of these physicians will be analyzed to achieve our goals in this paper. In 1922 the German bacteriologist Fritz Munk came to Rio de Janeiro and took part in the Second Brazilian Congress of Psychiatry, Neurology and Legal Medicine. At this opportunity Munk presented a paper about the Chagas Disease. In 1926 Moreira published a chapter with the title "Nervous and Mental Diseases in the Tropics" in the fourth volume of Carl Mense's (1861-1938) *Handbuch der Tropenkrankheiten* (Manual of Tropical Diseases). At last, in 1930 Hermelino Lopes Rodrigues (1898-1971), former student of Juliano Moreira, wrote an important book that will help us to achieve our goals: "The Mental Forms of Chagas Disease".

Psychiatry; Bacteriology; Tropical Medicine; Brazilian-German Scientific Relations; International Medicine Relations

Chagas' disease: medical records, therapeutic and prophylactic experiences in the Brazilian backlands

Renata Soares da Costa Santos, PPGHCS/COC/Fiocruz

The first decades of the twentieth century have highlighted national and international studies on Chagas' disease. Its history is intertwined with the transformations that occurred in the Instituto Soroterápico, baptized in 1908 as Instituto Oswaldo Cruz. This Institute was living a research expansion moment on human, animal and vegetable diseases based on expeditions to the Brazilian backlands in search of biological materials, revealing such expeditions little or unknown pathologies. In addition, many clinical consultations were carried out, which, in addition to studies on the biology of *Trypanosoma cruzi*, its cycle and its evolutionary forms in vertebrates and in the vector, gave rise to the conformation of the new disease presented to the scientific world by Carlos Chagas in partnership with other researchers from Instituto Oswaldo Cruz.

Among the scientific and political dividends provided by Chagas' disease were funds to equip a small hospital in Lassance for clinical studies on the disease and to build a larger hospital on the campus of the Institute – Hospital de Manguinhos – where the patients with pathologies identified in the hinterlands of the country would be hospitalized. In these places, until the 1920s, patients with Chagas' disease were investigated, objects of therapeutic and prophylactic experiences revealed by the records.

In the works published by Carlos Chagas we find detailed different analyses aspects of the disease that bears his name, but there are few references to prophylactic actions, geared generally to the dwellings where the vector was nestled. Moreover, the occasions in which he treated the therapy adopted in the cases that have been the subject of his observations over the years are very rare. Silence in this respect is astounding, especially when one reads clinical reports intended to make the new pathology known to Brazilian physicians, a symbol of "Brazil's disease", enabling them to recognize it but without giving it any help. Procedures with patients.

This communication deals with the Hospital of Manguinhos's medical recordings aiming to compose a framework of the therapeutic procedures adopted with patients diagnosed with Chagas' disease. The clinical records, anamneses, drugs used, given dosages, reactions to medications successes and failures and evolution investigative processes of the disease were identified in the medical recordings.

Hospital de Manguinhos; Chaga's disease; medical records

Visceral leishmaniasis cases diagnosed in Paraguay during the XX century

Rolando Oddone, Instituto de Investigaciones en Ciencias de la Salud

In 1911, Tropical Medicine made a breakthrough: the discovery of the first American case of visceral leishmaniasis (LV) in the Americas. Its discoverer was Luis E. Migone amid scarce resources and a turbulent socio-political environment. The patient presumably acquired the disease in Brazil. Paraguay then spent more than 30 years to find the first autochthonous case of the disease, which was carried out by Boggino and Maas in 1945. Later, during the visit of the Spanish pediatrician Peña Yáñez, 3 cases were diagnosed and reported between 1950 and 1951. Another 44 years passed to find another human case of LV, this time preceded by outbreaks of canine visceral leishmaniasis. Questions arise concerning the autochthonous cases reported. How can the long periods of time elapsed between cases be explained? Were certainly autochthonous the cases reported as such? How did the visit of foreign experts influence the diagnosis of cases? How can the actual number of VL cases be estimated, above the 5 autochthonous cases found during the 20th century in Paraguay? The answers to these and other questions will help to clarify the confusing panorama of Paraguayans cases of VL during that period. These situations are confronted with the worrying current epidemiological situation of the disease: more than a hundred human cases of LV diagnosed per year, in an environment of strong endemicity of canine visceral leishmaniasis.

Paraguay; Visceral leishmaniasis; History of Tropical Medicine

Sick Road: disease and development in the brazilian amazon (1958-1960)

Rômulo de Paula Andrade, Fundação Oswaldo Cruz

The purpose of this presentation is to highlight scientific researches on diseases during the construction of the Belem-Brasilia highway in the 1960s. In January 2016, the Brazilian periodic "O Globo" reported that a little-known disease was causing false diagnoses to patients and physicians who believed that the symptoms correspond to dengue fever, common in the summer of Rio de Janeiro. This disease was fever ORO, a painful viral syndrome and transmitted by Ceratopogonidae, also known as Maruim. Officially, since the 1960s, it has been reported more than 500,000 cases, but it is suspected that the numbers are lower than the actual manifestations, especially because of this diagnosis confusion. Many of the conditions for maruim reproduction were not exclusive to the Amazon, but also the part of the west of the city of Rio de Janeiro. According to experts interviewed by the report, it was an arbovirus responsible for over 50% of dengue diagnosis. Arboviruses (union of initial arthropod-borne-viruses) are viruses that can be transmitted to humans by arthropods (insects). These arboviruses give rise to easily recognizable diseases. Some mortals, other soft: encefalitites, mild fever, hemorrhagic manifestations, as well as milder forms recognizable only in laboratories. The first time the virus has been isolated in Brazil was in 1960, captured in a sloth on the banks of the then newly opened highway Belém-Brasília. The relationship between the onset of illness and the opening of the highway prompted researchers of the time. It's a bit of that story the purpose of this presentation. The analysis of a slight fever, not fatal, and at first glance, little relevant, brings up fundamental issues for understanding the links between health, politics and the Brazilian Amazon of the 1960s, with its road construction impacts, scientific institutions, scientific conceptions and field work.

BRazilian Amazon; History of the development politics; History of emerging diseases

Visceral leishmaniasis in Brazil: revisiting paradigms of epidemiology and control

Sinval Pinto Brandão Filho, Fiocruz

Filipe Dantas Torres, Fiocruz

In the last 30 years, despite the known underestimation of cases, Brazil registered a marked increase in the incidence of visceral leishmaniasis. The main goal of this study is to reflect on some aspects of this zoonosis in Brazil, the timeline and historical remarks on the actions of Brazilian control program of leishmaniasis and to encourage the discussion in order to find more viable, effective and affordable strategies to be implemented in the future by the Brazilian Leishmaniasis Control Program. The current situation of visceral leishmaniasis in Brazil might be seen as a paradox: the most important aspects of the disease are known, but so far, the control of this disease has not yet been achieved. The current control strategies have not been able to prevent the geographical expansion, and even a rise in the incidence and lethality of visceral leishmaniasis. There is a need not only for a better definition of priority areas, but also for the implementation of a fieldwork monitoring system to the disease surveillance that could permit a further evaluation of the control program in areas where visceral leishmaniasis is endemic.

Visceral leishmaniasis, control, historical perspective, Brazil

From the worm discovery to the global elimination program of lymphatic filariasis: bancroftian filariasis history

Zulma Medeiros, Fundação Oswaldo Cruz

Walter Lins Barbosa Júnior, Fundação Oswaldo Cruz

Silvia Bezerra dos Santos, Fundação Oswaldo Cruz

Ana Maria Aguiar dos Santos, Fundação Oswaldo Cruz

Time when the World Health Organization (WHO) seeks the global elimination of lymphatic filariasis (LF) with the implementation of the Global Program for Elimination of Lymphatic Filariasis (GPELF) in 1993, which aims to eliminate the parasitosis as public health problem up to the year 2020. The principal strategy for LF elimination focuses on annual mass drug administration (MDA) with antifilarial drugs. The neglected tropical diseases, LF, is caused by infection of three filarial parasite species, which *Wuchereria bancrofti* is responsible for 90% of the cases in the world and it is the only endemic specie in Brazil. The State of Bahia, northeastern Brazil, had the initial studies in 1866 with Otto Wucherer, considered the founder of the Brazilian helminthology, being observed for the first time microfilariae in urine, classifying the parasite as *Wuchereria bancrofti*. Wucherer, together with John Patterson, José Silva Lima and Silva Araújo, and other physicians living in Brazil, formed the “Escola Tropicalista Baiana”. Studies developed by this group, based on clinical observation and pathological research, have given a new direction to Brazilian medicine and are considered the predecessors of experimental medicine that was consolidated in Brazil in the beginning of the 20th century, mainly from Instituto Soroterápico Federal, headed by Oswaldo Cruz (Gurgel, Carneiro and Coutinho, 2010). From 1951 to 1955, it already existed in several outbreaks in the States of Amazonas, Pará, Pernambuco, Alagoas, Bahia, Santa Catarina, Rio Grande do Sul and Maranhão, according to the first national epidemiological survey developed by the sanitary doctor René Rachou, from National Malaria Service (Franco et al., 1967). Important advances in the knowledge related to the parasite biology, transmission, clinical characteristics, diagnosis and treatment of the disease were developed in Brazil, as well as in the applied researches for its control. This topic has not yet been explored in all its scope in the Brazilian historiography of health sciences, study on the medical and scientific trajectory of filariasis and, above all, on the contextualization of public policies adopted in Brazil and in the world for its control is necessary. It is very important to seek to understand not only the course of health research related to this disease, but also to build up the memory of this parasitosis that is about to be eliminated.

060. (Un)Bounded Doctors? Nation, Profession, and Place in the Local and Global Formation of Medical Groups in the 19th and 20th Centuries

Healing relations in Brazil: the introduction of homeopathy at the second half of the nineteenth-century

Beatriz Teixeira Weber, Universidade Federal de Santa Maria

New and diverse analysis viewpoints have been offered to the academic field that deals with history of health and illnesses at a social history background. From these new perspectives arises a large scope of interconnected social and institutional relations that encompass subjects that are only now acquiring speech. Physicians, healers, adepts of religious activities present themselves with differentiated status, but we have identified that these are subjects that engaged in dialogue and proposed options which included diverse interaction. This viewpoint that a new social history of health adopts allows us to understand the interchange of activities that were seen as separated for a great period of time, result of a historiography that reinforced the differences. These new viewpoints allow us to understand these practices as complex mixes of dialogues existing in a great variety of groups and behind the groups, on several times removing impairments. We highlight the introduction of homeopathy occurred in Brazil at the second half of the nineteenth-century and how its practitioners gathered supporters and conflicts when spreading their ideology.

Homeopathy history; medicine history; healing practices

The Cuban Medical Strikes of 1934: Class Formation, Labor, and the Radicalization of Cuban Medicine

Daniel A. Rodriguez, Brown University

This paper uses the Cuban medical strikes of 1934 as an entrypoint into the politics of medical labor during the Cuban Republic. It explores the radicalization of the Cuban medical sector, in the context of the political and economic crises of the 1920s and 1930s. During these years, Cuban physicians organized under the Cuban Medical Federation to protect their economic interests and targeted Havana's Spanish-run hospital system for its low wages and unfair practices. At the same time, an active campaign to overthrow the dictatorship of Gerardo Machado (1925-1933) influenced a new generation of young doctors and medical students, who pushed the federation to link its class interests to the broader political and social problems of the Cuban people. I argue that the social forces unleashed with the 1933 fall of Machado transformed the medical class, leading to increased support for the radical reconfiguration of Cuban medical practice. After a painful medical strike, the failure of international mediation efforts, and increased government hostility to the federation, the Cuban medical class increasingly pushed for the radical expansion of the public medical sector.

Medical labor; socialism; immigration; Latin America; Cuba

The Transnational Migration of Doctors and Nurses to, and from, Canada, c.1954-76

David John Wright, McGill University

Over the course of its history, Canada has welcomed a substantial number of foreign-trained doctors and nurses. However, the period 1954-1976 witnessed a unique event in twentieth-century Canadian medical and immigration history. In the context of a post WWII economic and demographic boom, many Canadian provinces aggressively recruited doctors and nurses trained abroad, licensing over 10,000 doctors and 25,000 nurses. This represented more than the number of health care practitioners that Canada had trained domestically during the same period. By the mid-1970s many communities – particularly those in rural and/or remote regions – were serviced primarily by foreign-trained health care practitioners. Nor was this a Canadian phenomenon: the influx of foreign-trained doctors and nurses had parallels in Britain, the United States, as well as Australasia. It was a new chapter in the globalization of health human resources.

This presentation examines this experiment in managing health human resources through targeted immigration by examining Canada as a case study. Canada has several remarkable features that make it of interest to international scholars. First, it was on the top ten list of countries identified by the World Health Organization as receiving the most doctors and nurses during this period; it was also, along with Britain, on the top ten list of countries losing medical practitioners and nurses. Second, the sheer size of the country provides for an interesting case study in the degree to which foreign-trained doctors and nurses were (or were not) diverted to underserved areas or channelled into 'unpopular' medical specialties. Third, the influx of doctors and nurses occurred at the very time Canada was implementing what would result in the most 'socialist' medical system of any western industrialized country. It thus offers an opportunity to examine the role of migrant medical practitioners in the evolution and sustainability of universal health insurance.

migration; Medicare; Canada; foreign-trained doctors

The organization of child care in Rio de Janeiro: State, philanthropy and health (1909-1928)

Gisele Sanglard, Casa de Oswaldo Cruz/Fiocruz

The context of institutionalization of pediatrics and childcare; And the transformation of child care is marked on the one hand by the worry for the child's body (and his health); And on the other hand, the problems arising from the social question in the city - the poor working and housing conditions, constant epidemic outbreaks (smallpox and yellow fever). The abolition of slavery and mass immigration gradually began to change the public of the Santa Casa da Misericórdia of Rio de Janeiro. This institution finish to created new medical care spaces, among them the Children's Polyclinic and the Hospital San Zaccharias - both dedicated Health of the child.

It is in this scenario that Antonio Fernandes Figueira emerges as one of the main leaders of this process. One of the most important questions for this doctor was the problem of infant mortality, which he raised during his professional life and marked his care project. Early childhood mortality affects the demographics of countries, especially when associated with low birth rates. This problem will certainly be aggravated by the poor housing, work and food conditions of the working family - issues that will mark the turn of the nineteenth century to the twentieth century in Brazil.

It is in this scenario that Fernandes Figueira starts to act and outline the public policies that he will put into practice from 1920 as chief inspector of the Child Hygiene Inspection - an organ linked to the National Department of Public Health. To give substance to this analysis, I will give special attention to the public served, the main diseases that afflicted them and the public policies that it constructed.

From Foreign Healers to International Doctors: Internationalism and the Consolidation of Homeopathy in Mexico, 1853-1942

Jethro Hernandez Berrones, Southwestern University

The liberal Mexican Constitution of 1857 gave Mexicans the freedom to pursue education and to practice the profession they wanted, though it prevented that future regulations would establish which professions required a diploma. The Constitution of 1917 left this right untouched, until the congress issued a law of professions in 1942. For almost a century, professional liberalism framed state policies to regulate professional training and practice as well as the market of the provision of services in Mexico. Similarly, it shaped popular resistance to such policies.

In Mexico, homeopaths constituted a persistent voice that challenged professional medical regulations throughout this period. Facing regulatory policies implemented by education and public health authorities, this particular group of doctors was able to open schools, issue medical degrees, and have these registered, overcoming state-imposed limitations to practice homeopathy. While homeopaths' success owed much to their ability to place themselves as regular practitioners endorsing a scientific medical approach and to constitutional law, they also relied heavily on homeopathy's foreign nature and homeopaths' foreign allegiances and alliances.

This paper analyses the international influences that homeopaths and state officers brought to national disputes about medical training and practice. Using cases from the mid-19th century to the early 1930s, I analyze the role that the national-foreign dichotomy played in the regulation of the Mexican medical profession. How did homeopathy's German origins influence its reception by doctors who favored French medicine and by patients whose allure of the foreign inclined them to everything European? How did the first homeopaths' foreign origin impact regulations to restrict the registration of non-local physicians? How did successful homeopathic remedies to combat epidemic disease abroad and their foreign marketing strategies influence government officers' and patients' endorsement of homeopathy as well as doctors' distrust? And finally, how did Mexican homeopaths use international homeopathic meetings to raise awareness of the importance of national homeopathy in the international context in support of the national cause? In the interactions between national projects and foreign influences, homeopathy evolved from a minor foreign therapy practiced by foreign physicians to a national medical alternative with international projection and recognition.

Internationalism; medical profession; regulation; homeopathy; Mexico

Collaborating with the Enemy: French Surgeons, Mexican Practitioners and the Mexican Academy of Medicine, 1866

Luz Maria Hernández-Sáenz, University of Western Ontario

The health-care occupations underwent radical changes when Mexico transitioned from a colonial, corporative society to a liberal, independent republic. The process of modernization was slow and tortuous due to the fluid politics of the time and deplorable financial situation of the country. Nonetheless, the medical leadership proceeded with the reform, working with the authorities to ensure legal recognition of their professional rights and position. At the same time, the physician-surgeons reaffirmed their privileged place by establishing a medical school to monopolize and control specialized medical knowledge, and sought to gain recognition as the guardians of such knowledge by forming an academy.

The importance of an academy to contemporary practitioners cannot be understated. Rapid medical

developments increased the need for better communication among scientists. An academy offered the opportunity to discuss innovation and personal experiences with colleagues, weave a professional network, and develop professional self-assurance. Most important, an academy allowed participants to claim their place among those who possessed specialized knowledge; thus was indispensable for the legitimization of the profession and the recognition of the scientific efforts of the new nation. The efforts of Mexican practitioners to establish a permanent academy ran parallel with their struggle to provide and control medical education and gain national and international recognition. This presentation will focus on the unique political, scientific and social circumstances that resulted in the establishment of the present day Academia Nacional de Medicina de México. The founding of the Sociedad de Medicina and its professional consequences challenge the nationalistic views of Mexican political and medical history as well as traditional studies of cultural imperialism. The remarkable collaboration between local practitioners and the military surgeons of the army of occupation during the crucial years of 1864 to 1867 underline the important role that foreigners played in nineteenth-century Mexican medicine. It also illustrates that by approaching the French Intervention of Mexico through the lens of political versus medical history the historian may reach very different conclusions. In the case of Mexico, foreigners and nationals collaborated in the modernization of medicine and subsequently in the formation of the modern Mexican nation.

Academy; Medicine; Mexico; French Intervention; professionalization

061. Chemistry, Pharmacy and Medicine: Between the Local and the Global

Development of photobiochemistry in 20th century Brazil

Andreia Medolago de Medeiros, CESIMA - PUC SP

Giuseppe Cilento was born in Italy to then move to Brazil, where he lived to his death in 1994. In 1943 he took a degree in chemistry from University of São Paulo, a course initiated just a few years earlier. In the early 1950s Cilento began to consider the hypothesis that excited triplet-state species could form in biological systems, thus providing them the energy required to form activated oxygen and free radicals. Extension of this program to other biochemical systems led him to suggest, in the 1970s, that triplet states could also account for luminescent emissions in biochemical systems in the absence of light. These ideas were discussed in Brazil and abroad, leading Cilento to contact and collaborate with chemists from the most reputed national and international laboratories. In addition, he had an active role in the foundation of Brazilian universities and research support agencies. In this presentation I will discuss Cilento's contribution to the creation and institutionalization of a new field of research, namely, photobiochemistry without light, as well as the relevance of his work for the development of several scientific fields.

History of the Science; History of the Chemistry; Giuseppe Cilento; photobiochemistry

Argentinian Navy pharmacy: notes for social-historical reflections

Celina Ana Lértora Mendoza, Fundación para el Estudio del Pensamiento Argentino e Iberoamericano (FEPAl)

Naval pharmacy has a long history in Argentina, which began almost together with the Independence wars started in 1810. Preparation of adequate professionals, a concern with the procurement and/or manufacture of medicines, particularly in critical times of war, the need to contribute to the port

sanitation, and quarantines during epidemic outbreaks extended all along the 19th century. The naval pharmacy consolidated as a one of the service branches of the Argentinian Navy, as it was also the case of the Army, and later on also of the Air Force.

Starting in the mid-20th century, the Navy pharmaceutical laboratories manufactured a wide range of medicines, which were distributed to military personnel and recruits gratis, and also within the context of military interventions (catastrophes, accidents, etc.). Liberalization of economy and development of outsourcing as governmental habit in the 1990s resulted in increased cost, whence this traditional service became rated unnecessary, as the same medicines could be purchased abroad at lower price, as the exchange rate was favorable to Argentina. The naval pharmacy was therefore closed.

A few years later, an economic crisis left Argentina in a state of quasi-chaos, which compelled the government to establish drastic measures vis-à-vis the increase in the cost of medicines resulting from the devaluation of the Argentinian currency. Eduardo Duhalde assumed as interim president during a period marked by serious social conflict and succeeded in passing a law compelling doctors to prescribe generic drugs. Thus, the conditions were ideal for governmental laboratories to supply such drugs at low cost. The naval laboratories could have filled this role, but did no longer exist. For more than ten years many professionals are striving, albeit unsuccessfully, to reopen closed governmental laboratories and optimize the operation of the available ones for the law on generic drugs to fulfill its role, resulting in reduction of the cost and increase of the coverage of medicines supply to the poorer strata of society.

History of Pharmacy; Naval Pharmacy; Argentinian Science

Communicating and discussing some chemistry and medicine aspects through a personally centred correspondence

Isabel Malaquias, Universidade de Aveiro, Dept Physics, CIDTFF

The last quarter of the eighteenth century assisted to several improvements in science and technology, being chemistry, medicine and scientific instrumentation in the top of the most fascinating subjects. Being an expert and also a very active writer, either through his correspondence or by publishing several memoirs, mainly on instruments, J. H. de Magellan (1722-1790) detached from his condition of a former abbot to a prolific man of science connecting and making himself a correspondent of all known men of science from different parts of the world.

In this presentation we will bring some light on three particular examples that put some evidence on that specific dynamics making connection between chemistry, pharmacy and medicine purposes and the mechanisms of global interrelationships between people, commodities, information and knowledge. We will focus on information concerning the appearance of a new cinchona species collected in South America, the request for an effective evaluation of the species, its properties and acceptance as a medical febrifuge, the foxglove and the dissemination of its medical function and some particular aspects of medical care beyond frontiers, mediated by J. H. de Magellan. It will be shown this new facet of Magellan's contribution to the appreciation of the dynamics process of science dissemination.

history of chemistry; history of medicine ; J.H. de Magellan; eighteenth century; local and global science

Pharmacist and the foundation of the Faculty of Chemical Sciences in Mexico

Liliana Schifter Aceves, Universidad Autónoma metropolitana Xochimilco

Mariana Ortiz Reynoso, Universidad Autónoma del estado de México

The history of Mexican chemistry and pharmacy during the first two decades of the XXth century have been often considered as obscure and dull, specially the years prior to the inauguration of the National School of Industrial Chemistry. We do not believe this to be the case; our approach positions secondary chemists in the center of the discussion to understand the context in which chemistry developed during this period and dismantle the myth of the creation of the National School of Industrial Chemistry in 1916, as an event exclusively linked to the figure of its first Director: Juan Salvador Agraz.

Our purpose is analyze how and where chemistry developed in Mexico, the activities linked to it and the main social actors involved in this process. We do not want to present the history of chemistry in Mexico during this period as an extension of what happened in Europe, however will use the situation of chemistry in this continent as referential frame to highlight the particularities of the Mexican case. In Mexico, during the XIXth century and the beginning of the XXth, teaching, research, as well as public and private services concerning chemical matters, were mainly performed by pharmacists. These scientists agglutinated in a complex network which gave them visibility and allowed them to negotiate the initiatives necessary for the creation of new spaces where chemistry was produced, taught, practiced and eventually, professionalized.

They created the first Mexican Chemical Society in 1910 and also had a fundamental role in the constitution of the Faculty of Chemical Sciences and Pharmacy in 1919, where the study of the chemistry and pharmacy as independent disciplines was institutionalized and became autonomous.

chemistry; pharmacy; institutions; Mexico; XXth century

Presence of American native plants in Portuguese and other European pharmacopoeias in the 18th and 19th centuries

Marcia Helena Mendes Ferraz, CESIMA/ Pontifical Catholic University of São Paulo

Ana M. Alfonso-Goldfarb, CESIMA/ Pontifical Catholic University of São Paulo

Silvia I. Waisse, CESIMA/ Pontifical Catholic University of São Paulo

The earliest Portuguese pharmacopoeias were produced at the end of the 17th century. While new pharmacopoeias appeared in the 1700s, also the scope of pharmaceutical and pharmacological works became much broader, including recipe books and works on materia medica. Within this context, the contributions by Jean Vigier (b. 1662), a Frenchman established as drug-maker in Lisbon, stand out. Vigier's *Farmacopeia ulissiponense, galénica e química* (1716), based on N. Lémery, describes the basic chemical operations used for the preparations of medicines. In addition, he devoted one full chapter to native plants from Brazil and other parts in the Americas, based on W. Piso's (1611-1678) descriptions. Not many Portuguese authors included 'New' World plants in the pharmacopoeias. One relevant exception is A.A.S. Pinto, a physician who upon learning that his *Código Farmacêutico Lusitano* had been declared of mandatory use in Brazil, added a section on American plants, believing that he would thus facilitate the work of Brazilian doctors and apothecaries.

Based on the American plants included in the aforementioned pharmacopoeias, in the present study we seek to establish whether the interest on such plants reflected somehow on pharmacopoeias published in other parts of Europe during the 1700s and 1800s.

History of Science; Pharmacopoeias; American Medicinal Plants; 18th and 19th centuries; Vigier

Antisyphilitic treatments in Brazil: cases suggesting the protagonism of patients in the 19th century

Maria José Saenz Surita Pires de Almeida, Universidade Federal de Mato Grosso do Sul

One of the most controversial issues among physicians and syphilis patients throughout the 19th century may have been making the best treatment choice. In Brazil, the wide range of remedies supposedly used during this period surpassed mercury – said by specialists at the time, to be oldest substance with anti-syphilitic properties having different application forms.

It is likely that the remedies varied according to the region where the patient lived – cashew fruit, for instance, was popularly known in the province of Alagoas as the “mercury of the poor”. In Minas Gerais and Goiás, the japecanga (*Smilax brasiliensis*) was used as medicine through cooking. Depending on the place, there was a preference for plants such as salsaparilla (*Smilax omata*), velame-do-campo (*Croton campestris*), laranja-amarga (*Citrus aurantium*), manacá (*Tibouchina mutabilis*) and caroba, among others. Depurative herbal remedies were prescribed for baths, fumigations, pills, patches, salves and injections.

Continuing the research I started during my master’s degree course, in the present work I carry on analyzing medicine journals and compendia in order to identify remedies used between 1820 and 1890, in Brazil and France. I support the hypothesis that the physicians then did not always have the autonomy to prescribe the medication they believed to be the most suitable. On the contrary: some were forced to negotiate with their patients, giving in to their demands. There were men who sought more discrete treatments, received in secret, and therefore refused to use injections and mercury balms so as prevent other people from knowing they had syphilis. This concern was justified by the fear of moral judgment, as suggested at the writings of the famous French physician Alfred Fournier (1832-1914).

The protagonism of the patients while choosing the treatment to “cover up the disease” can be understood based on historian Roy Porter’s (1946-2002) concept of “medicine history seen from below”.

History, Syphilis, treatment

Pharmacy and Pharmaceutical Patents in México within the first quarter of the XIXth century

Mariana Ortiz Reynoso, Universidad Autónoma del Estado de México UAEM

Liliana Schifter Aceves, Universidad Autónoma Metropolitana Xochimilco

Jonnathan Santillan Benitez, Universidad Autónoma del Estado de México

Hariz Islas Flores, Universidad Autónoma del Estado de México

Martha Díaz Flores, Universidad Autónoma del Estado de México

Enrique Morales Ávila, Universidad Autónoma del Estado de México

During the government of General Porfirio Díaz, various actions were carried out to promote the country's industrialization and development of science and technology. Among the measures taken, spaces for scientific research and specialized schools were opened, such as the Escuela Nacional Preparatoria, the Escuela Nacional de Agricultura, the Instituto Médico Nacional and, later, the Escuela Nacional de Ciencias Químicas teaching were inaugurated.

Mexico contributed largely to the study of a large number of therapeutic plants through research conducted at a quite peculiar institution, the Instituto Médico Nacional (National Medical Institute – NMI). NMI was created in 1889 (to close its doors in 1915) to investigate the so-called national therapeutics, namely, the one based on the empirical knowledge preserved in the folk tradition. Originally, the NMI was divided into five sections: Natural History, Experimental Physiology, Analytical Chemistry, Experimental Therapeutics and Medical Geography and Climatology; a few

ICHST
2017

years later a Department of Industrial Chemistry was also established.

The so-called Mexican positivism was raging with a peculiar pragmatic and nationalistic emphasis. Mexico showed the world as a lush in natural resources willing to exploit them. During the last decade of the century, laws were enacted to stimulate the development of technologies and industries. Specifically, the law of 1893 on franchises to new industries gave concessions and privileges to entirely new industries in Mexico. The legal measure granted franchises for up to 20 years (with the right to be revised later) to the companies that installed factories producing goods hitherto not manufactured in Mexico.

This measure sped up the patent application to the Secretaría de Fomento (Ministry of Development), which was the body responsible for regulating intellectual property in the country. In the field of therapeutic products, dozens of applications were submitted in the stage in the late nineteenth and early twentieth century.

This work aims to revise patent applications of medicinal products submitted to the Ministry of Development during the same period in which the National Medical Institute was active and assess the role played by this research center in generating industrial property rights related to Mexican drugs.

Drugs, patents, local flora

How traditional Chinese materia medica entered into modern medicine in China, 1956-1977

Métailié Georges, Centre Alexandre Koyré, Paris, CNRS

During the first half of the 20th century Traditional Chinese Medicine had been progressively dismissed in China by the authorities until the moment when it was even forbidden in the 30th, "modern medicine", i.e. Western medicine alone being authorized. The situation changes dramatically after 1949 when, on the contrary, for various reasons, TCM was highly valued and studied. I would like to give an insight into the process which occurred in the field of plants of the traditional materia medica.

Chinese medicine, medicinal plants, 20th century

From quine to quinine sulfate medical observations in the 19th century western world

Nanci Leonzo, USP/UFMS

On 16 April 1815, one of the many Portuguese citizens who settled down in Rio de Janeiro due to the transference of the Portuguese Royal Family to Brazil, shipped to Portugal 150 arroba of Brazilian quine, which he considered as good as the one originated from Peru. The first discoveries of the so called brasiliensis quine, or country quine, made in different Brazilian provinces date from the second half of the 18th century. However, some of the first printed news on the efficacy of that medicine was probably published by an Italian, especially concerning the diseases diagnosed as "intermittent fevers", considering here their various types.

In the beginning of 1821, four out of seven official kinds of quine were known in southern America according to a Brazilian doctor settled in Rio de Janeiro. This information was provided by a Spanish botanist who did some research on the Bogotá (Colombia) flora at the end of the 18th century. In 1735 and 1737 respectively, two Europeans undertook the pioneering task of investigating the "Peruvian Bark". Two disciples of the French pharmacist and chemist Louis Nicolas Vauquelin, Pierre

Joseph Pelletier and Joseph Bienaimé Caventou, studied alkaloids found in plants, and in 1820 processed the quinine, generic name of the barks from different cinchona trees from the rubiaceae family. The result of this analytical process led to the discovery of the sulfate of quinine.

In the middle of the following decade in Brazil, it was possible to count on that new drug, although the most reliable version of this medicine was imported from England. It is important to remember that the manufacturing of the sulfate of quinine was costly, despite the fact that this remedy was widely used for internal and external treatments.

Around 1881 the sulfate of quinine was predominant in many parts of the western world. In the first decade of the 20th century in Brazil, it was usually substituted by the hydrochloride of quinine, especially in prophylaxis and treatment of paludism/impaludism, currently known as malaria. The knowledge about the quines in Brazil had already been improved by then and to some people its properties were similar to its Peruvian variety.

quine; quinine sulfate; brazilian quine

Les laboratoires coloniaux de Napoléon : les lieux de la chimie, la pharmacie et la médecine pendant l'occupation française de l'Égypte (1798-1801)

Patrice Bret, Centre Alexandre Koyré & GHC/SCF, Paris

L'expédition de Napoléon Bonaparte en Égypte est restée célèbre dans l'histoire de la chimie parce que le laboratoire naturel des Lacs Natron a bouleversé la compréhension des réactions chimiques par Claude-Louis Berthollet et conduit à son "Essai de statique chimique". L'histoire de la médecine a retenu la "Topographie médicale de l'Égypte" réalisée sous le contrôle de René Desgenettes. Mais on sait moins que l'expédition d'Égypte a vu également l'établissement et le fonctionnement éphémère des premiers laboratoires et cours d'enseignement médical européens en terre africaine.

L'exposé présentera d'abord le groupe hétérogène des chimistes, pharmaciens et médecins attachés à l'armée ou à la Commission des sciences et arts de l'expédition. Nous présenterons ensuite les fonctions et activités des laboratoires de chimie et de pharmacie - sans oublier les enjeux scientifiques et économiques autour de la production du natron - et celles des amphithéâtres d'anatomie pour l'enseignement médical en terrain colonial.

Qu'ils aient été destinés à approvisionner une armée d'occupation isolée de ses bases métropolitaines (laboratoire de la pharmacie centrale de l'Armée d'Orient) ou à préparer la « colonisation nouvelle » (laboratoires de chimie de l'Institut d'Égypte, des hôpitaux ou d'établissements à caractère industriel), les laboratoires ont été des lieux d'expertise et de contrôle de la production (médicaments, alliages monétaires, poudres et salpêtres...) et des lieux d'analyse et d'expérimentation chimique (eaux, terres, natron...) et d'innovation instrumentale (mesure de l'inflammabilité des poudres). Ils ont été aussi une vitrine de la science européenne auprès des notables du Caire, tandis que les sites égyptiens de la chimie ont été l'objet d'études.

History of Chemistry; History of Pharmacy, Medicine and Surgery; Laboratories; Colonial Science; Science and Empire

Science to the service of justice: Criminalistics as an aid to penal procedures in Brazil

Roselle Adriane Soglio, PUC-SP

The aim of this presentation is to discuss the process of inclusion of Criminalistics in the state of São Paulo, Brazil, from its inception to its crystallization signaled by formal adoption of the technical

proof by the legislation – Penal Code (1941).

Criminalistics is a specific theoretical and practical field that aims to produce reliable inferences on the identity of the author of a given crime based on material clues left at the crime setting. As such, Criminalistics originated in Europe at the end of the 19th century through a process based on the adoption of science not only as provider of concepts and techniques for investigation and inference, but also the methods for forensic investigation.

Criminalistics arrived to Brazil in the beginnings of the 1910s, São Paulo in particular, through a course taught by the Swiss criminalist Rudolph A. Reiss (1875-1929). This event was the trigger for the creation of a Technical Police in the state of São Paulo. To be sure, the government of São Paulo had been seriously investing on public security, for which purpose it created an anthropometric cabinet at the Police Central Headquarters, and in 1908 adopted the criminal identification system based on fingerprints developed by Juan Vucetich. However, it was Reiss' teachings that changed the history and course of the investigations conducted by the Paulista police, since scientific methods were included in criminal investigation.

Criminalistics; Forensic Science; Anthropometry

Quelques gouttes qui changent tout. Les recettes du quinquina

Samir Boumediene, CNRS

A partir des années 1640 est importée en Europe une écorce péruvienne soignant les fièvres paludiques (ou "intermittentes"), le quinquina.

Jusqu'à la fin du XVIIIe siècle, l'extraction de cette écorce, son passage vers l'Europe et son administration aux malades transforment conjointement la théorie et la pratique médicales, le gouvernement de la santé, le commerce des drogues exotiques et les paysages andins. Le but de cette communication est de suivre, à travers la relation à ce matériau médicinal, la reconfiguration des rapports entre Indiens, missionnaires jésuites, marchands, médecins, apothicaires, droguistes et malades. Diverses sources, en particulier les recettes du quinquina, permettent d'approcher la dimension politique des savoirs de la transformation en observant comment, par où, et à travers quelles limites s'établit une solidarité entre maîtrise de la nature et maîtrise des activités humaines.

Drugs; Recipes; Global Trade; Local Uses; Amerndians

062. Knowledge Translation in Mental Health: History and Forms of a Global Imperative

Irresponsible Translation: The Nationwide Screening of Students' Mental Health in South Korea

Buhm Soon Park, Korea Advanced Institute of Science and Technology (KAIST)
Youjung Shin, Korea Advanced Institute of Science and Technology (KAIST)

In late 2011, a few students in South Korea committed suicide, leaving notes about physical and mental violence they had endured in school. This was only a fraction of the rampant violence taking place in elementary, middle, and high schools. As a measure to tackle this problem, the government had been planning on the mass screening of students' mental health, and actually carried out the nationwide examination in 2012. Of 648 million students examined, 105 million (16.3%) were

categorized as “a group to be concerned” and 22 million (4.5%) as “a group to be cautioned,” i.e., as those who would need some sort of follow-up measures and actions.

Yet Korea was not the first country to conceive nationwide mental screening. In 2002, President George W. Bush (1946 -) established the New Freedom Commission on Mental Health to conduct a review of the U.S.’s mental health delivery system. After a year-long study, the presidential commission submitted final report, recommending comprehensive mental health screening for all people in order to uncover hidden patients. This screening was not realized, however, due to strong oppositions by parents and civic groups, who criticized it as an attempt to protect the profits of pharmaceutical companies at the expense of the public.

What made it that the Korean government could initiate and proceed the mass screening project that its U.S. counterpart could not have pursued before? This paper seeks to answer this question by analyzing multi-layered translation beyond bench-to-bedside translation of medicine: i.e., the translation of policy instrument from one country to another (selective benchmarking); that of problem definition from the social to medical realm (biomedicalization); and that of cultural values from one context to another (bureaucratization).

irresponsible translation; mental health; nationwide screening; South Korea

From Auguste Deter to Modern Genetic Testing: A Century of Alzheimer Research between Promises, Funding Expenses, and Meagre Therapeutic Success

Frank W. Stahnisch, University of Calgary

The 20th century saw an increase in neuroscientific research activities, culminating in the US' designation of the “Decade of the Brain” (1990-1999). Collaborative efforts brought about enormous activities in neurogenetics, brain imaging, and clinical psychiatry. Yet despite such obvious advances, critical voices have since raised important issues about the relationship between the amount of neuroscience research and the availability of new drugs, treatments, and social applications. The early developments in Alzheimer’s disease, which forms the case study of this research project, already begins in 1901 at the then City Mental Asylum in Frankfurt, where patient Auguste Deter was diagnosed by brain psychiatrist Alois Alzheimer (1864–1915). Alzheimer, who had based his psychiatric research on the methodological use of neurohistology, saw that the new staining technique also allowed for the visualization of structural changes within the nerve cells themselves, a technological advancement that fostered innovative studies of the intracellular conditions in degenerative diseases. With these advances he could identify the famous neurodegenerative disease form, which still bears his name until today.

Research on the historical development of innovative research work in neuromorphology since has shown that the models, which were designed to interpret the emergence of new disease concepts, forms of research interpretation, and the changes of treatment options, require modification for studies of long-term neuroscientific trajectories (Hagner, 1997). In particular, influenced by the analyses of Keating and Cambrosio (2006) on the role of biomedical platforms that realign the normal and pathological dimensions, historical and epistemological approaches have been modified to better capture laboratory research practices, changing subject ontologies, and contexts of usage. When applied to the reconstruction of Alzheimer research settings since the early 1900s, the changes of Alzheimer’s Disease to become a neurodegenerative disease in the 1940s, the environmental hypotheses (1970s and 1980s), and the current genetic and prion hypotheses (around 2000) (Satel and Lilienfeld, 2013), the KT aspects are scrutinized through discussions and regulation publications from international neurological and psychiatric associations (Demazeux and Singy, 2015).

Alzheimer's Disease, Knowledge Translation, Critical Analysis

The Failure of the Translation Model in the History of Psychopharmacology

Edward Shorter, University of Toronto

"Every psychiatrically useful drug starts as an erroneous theory, is discovered by serendipity or was a me-too." Donald Klein, 2016

The translation model implies the existence of an enabling stage between basic science, where (presumably) theory holds sway, and clinical application, where therapeutic results count. Despite progress in neurochemistry and neurophysiology, however, this translational stage has never proven its merit in the history of psychopharmacology.

The application of basic science to psychiatry began in 1955 in the laboratory of Bernard Brodie (1907-1989) at the National Heart Institute of NIH. Here, the concept of inhibiting the reuptake of neurotransmitters was developed, and with the simultaneous demonstration of efficacy in such agents as chlorpromazine (in 1952) and imipramine (in 1957), it looked as though a translational stage of linking specific neurotransmitters to specific psychiatric diseases was in the offing.

This translational project never materialized, because a) the theory of inhibiting neurotransmitter reuptake was vastly incomplete, and b) psychiatry failed to develop convincing phenotypes of disease that could serve as targets in drug discovery and development.

The result of this failure in knowledge translation has been, at the clinical level, aridity in psychiatric drug development for the last 30 years, and at the basic science level, the failure of the reuptake model to lead us to new discoveries of importance.

Psychopharmacology; Translational Research; Neurotransmitter Reuptake Inhibition; Basic Science; Clinical Application

Knowledge Translation as Ethical Challenge: the Case of "Covert Awareness"

Fernando Vidal, ICREA (Catalan Institution for Research and Advanced Studies)

The ethical dimension of Knowledge Translation (KT) has by no means been ignored. The Canadian Institutes of Health Research have made it inherent to KT, which in their wording comprises "the exchange, synthesis and ethically-sound application of knowledge." In that framework, the ethics of KT has mainly referred to the need for interventions to follow the standard bioethical principles of beneficence and non-maleficence, comply with legal and regulatory norms, and take social and economic consequences into account. These considerations are ultimately subordinated to the question, What should be done? A major area of potential KT emerged in 2006 when, using functional magnetic resonance imaging, a team led by neuroscientist Adrian Owen detected in a patient who was diagnosed as being in the vegetative state the capacity to modulate brain activity in response to spoken instructions. Later research using fMRI and other techniques seemed to confirm the beginning of "a new era of coma and consciousness science" – an era in which those techniques will enable a better diagnosis of noncommunicative patients, and allow those who possess "covert awareness" to communicate by modulating their own neural activity. The present talk will sketch the debate that followed Owen's findings in the perspective of KT.

covert awareness, disorders of consciousness, knowledge translation, neuroimaging

063. Health, Gender and Sexualities: the Making of Difference

The changing place of sex-reassignment surgery in transition pathways : from transsexualism to gender non-conforming in France

Alain Giami, INSERM - Institut National de la Santé et de la Recherche Médicale
Nayak, Lucie, INSERM, CESP, France

Changing sex through what is called “sex-reassignment surgery” and hormonal therapy has become a dominant approach since the 1950s in the Western world’s paradigm of gender identities. For several decades now, such procedures have been seen as an intrinsic dimension of the “syndrome of transsexualism”. Accordingly, the fine-tuning of these treatments represented medical and scientific progress at the service of persons who wanted to change to the sex opposite to the one assigned at birth. More recently, the “trans apparatus” — a word we use to encompass medicine, organizations of trans persons, legislative and judicial institutions, and administrative authorities — is undergoing major changes as multiple forms of gender identification have emerged that explode the binary sex/gender model underlying “transsexualism”. As our survey carried out in 2009-2010 (Giami, Beaubatie & Le Bail 2011) has shown, only a minority of trans people (approximately 30%) had had an operation performed on their genitalia.

Ensuing from a statement issued by the Defender of Rights (a French administrative authority) and a vote by the National Assembly in 2016 that abrogated the legal requirement of sex-reassignment surgery prior to changing one’s civil status. However the procedures for undertaking a gender transition with coverage under public health insurance funds still depend, in France, on obtaining a psychiatric certificate of “gender dysphoria”.

This new situation has roiled the discourses and practices of the medical teams specialized in administering hormonal and surgical procedures for the transition from one sex to another. They are now disoriented when handling requests that do not fit into the therapeutic procedures established in line with the binary sex/gender model.

This presentation explores the passage from the binary model of treatment for “gender identity disorder” to a more diversified model of “gender nonconformity” that emphasizes the types of relations formed between care-givers and the persons who use their services.

Initially these two parties were allies, but they are now often at odds. This paper examines the controversies related to the place of the binary and nonconforming model in the approach that individuals adopt toward a gender transition in France. It is based on observations conducted during medical conferences on trans issues that were held in Amsterdam, Paris and Bordeaux in 2016).

Transgender; Medicine; Medicalization; Psychiatry; Sexology

Three positions on Science, Politics and Gender: Reconsidering the value of Science in an era of suspicion of the European Universalism

André Luis de Oliveira Mendonça, Universidade do Estado do Rio de Janeiro
Gabriela Pimentel Barreto, Universidade do Estado do Rio de Janeiro

Taking into account the imbrications and intersections connecting each other, one can opt to say that there has been three different positions on the issue of the relation between Gender and Science for the last five decades: 1- Critical position on the “Sexism” of the Scientific communities, which is understood as a social phenomenon in which the most valued and important Science is mainly performed by men. 2- Critical position on ideological influence of the men’s point of view in relation to the contents associated to cognitive of Science in which the scientific theories would reproduce the sovereign machismo in the patriarchal society. 3- Critical confronting about Science which is

understood as a political enterprise of domination and control. The first aims at more access of women to Science and it can be called as sociological position; the second tries to change and improve Science through women's participation and it can be called as epistemological position, and the third aims at the overcome of the predominance of Science as a social power to serve the patriarchal, racist and euro-centered society and capitalism and it can be coined as political position (we will highlight the perspective of the so-called: "intersectional feminism"). Here, it is intended to establish a useful, open and sincere dialogue with the defenders of the three respective positions, taking into account the premise that it is urgent and necessary to rethink the value of Science in societies which are considered democratic in an era of questioning and suspicion of the so-called European Universalism, which Science has traditionally been seen as one of the greatest fortress.

science; health; intersectional feminism; gender; european universalism

Oxytocin and the reenchantment of motherhood

Jane Araujo Russo, Universidade do Estado do Rio de Janeiro
Marina Fisher Nucci, FIOCRUZ

Brazil is the world champion in the number of cesarean births, especially in the private health sector. The number of cesareans may reach more than 90 percent among pregnant women in the middle and upper classes in some regions of the country. Opposed to this state of affairs, the movement of "humanized birth" has been gaining strength, with the aim of denouncing "obstetric violence" and promoting the return of a "natural" form of parturition and care for the newborn. In this presentation we intend to discuss the uses of a supposedly scientific discourse on the role of oxytocin in "natural birth" by the supporters of this movement and the way such a discourse contributes to the construction of a renewed conception of motherhood.

hormone, oxytocin, motherhood, birth

The interface between science and policy: male circumcision and HIV/AIDS prevention in the World Bank literature

Kenneth Rochel de Camargo Jr, Universidade do Estado do Rio de Janeiro
André Luis Oliveira Mendonça, UERJ
Cristophe Perrey, INSERM
Alain Giami, INSERM

The objective of this presentation is to discuss the relationship between scientific evidence and the adoption of evidence-based measures in public policies based on the analysis of documents available in the WordBank database which mention the proposed adoption of male circumcision (VMMC) as a form of prevention of HIV / AIDS. We use the theoretical and methodological framework of the social studies of science, which assume that there is an inseparable intertwining between facts and values. Although relatively distinct conceptions about the issue were present, all documents favored the adoption of the measure as public policy for some countries of Southern Africa. There was also the predominance of a reductionist conception both of what constitutes scientific evidence, as well as of the notion of expertise. The analysis depicted a narrow technicist view, consistent with the general approach of the institution. To overcome that, in our view, it would be necessary, on the one hand, to overcome the traditional conception of scientific evidence and, on the other, an updating of the idea of expertise.

“Who's afraid of the bearded woman?": Hormone therapies and the biomedicalization of female sexuality

Livi F. T. de Faro, Latin-American Center on Sexuality and Human Rights (CLAM/IMS/Uerj)

This paper discusses the reconfiguration of the so-called ‘hormone replacement therapies’ (HRT) as sexual technologies, in the last decades. Using examples from my research on the technoscientific production and promotion of testosterone to boost female sexual desire, in Brazil, I argue that not only has testosterone been added into the HRT mix – targeting ‘spontaneous desire’ or ‘low libido’ in women – but HRT have been redefined as a means of restoring the ‘receptivity’ in heterosexual intercourse. I explore how the discourses and practices of sexual medicine and gynecology enact notions of sex differences and female sexuality. In doing so, I intend to contribute to the critical studies on the gendered aspects of the biomedicalization of the aging bodies.

biomedicalization, sexuality, gender, hormones, feminism

Producing gender during an epidemics: Zika as a sexually transmitted disease

Lowy Zelmanowicz Ilana, COC Fiocrus, CERMES 3, INSERM, Paris

Zika infection, linked with Guillain Barre syndrome and, above all, with risk of severe inborn impairments, was initially presented exclusively as an arbovirus—a virus transmitted by a mosquito, in this case nearly exclusively the mosquito *Aedes aegypti*. Later, however, evidence pointed to the transmission of this virus through sexual relationships, mainly from men to women. Debate on sexual transmission of Zika were prominent in countries where the *aegypti* mosquito is absent, or rare, such as the US and Western Europe. By contrast in countries, such as Brazil, where the massive presence of this mosquito is a an important public health problem because of its key role in the transmission of other arboviruses, dengue, chikungunha and yellow fever, sexual transmission of Zika was presented as non-existing or at best marginal problem in spite of indirect evidence that that is not the case. My talk will trace the history of studies on sexual transmission of Zika, and will discuss the role of framing Zika as a STD and resistance to such a framing in a situated construction of gender relationships.

Zika, sexually transmitted disease, framing disease, gender

Think global, act local: la réception de la sexologie américaine en Suisse romande (1960-2000)

Stephanie Pache, Harvard University

L’histoire de la sexologie est marquée par les travaux américains développés au cours du XXe siècle par des figures pionnières de la légitimation scientifique et médicale de la discipline comme le duo William H. Masters et Virginia E. Johnson. L’historiographie s’est cependant encore peu intéressée à la fois aux dimensions cliniques de cette école sexologique, et aux modalités de leurs mise en pratique localisée. Cette contribution se centre sur les pratiques que des sexologues suisses élaborent en s’inspirant des

travaux pionniers de la sexologie américaine dans des dynamiques locales de réappropriation théorique et de traduction thérapeutique. Le contexte suisse romand étudié offre ainsi un cas de réception clinique donnant à voir une stratégie de métissage thérapeutique éclairant les négociations en jeu dans les usages locaux de savoirs sexologiques américains.

The history of sexology is marked by the American research developed during the 20th century by pioneers of the scientific and medical legitimization of the discipline, such as the pair formed by William H. Masters and Virginia E. Johnson. However, the historiography has hitherto showed little interest both for the clinical dimensions of this sexological school and for the ways those dimensions are applied locally. This paper focuses on practices formulated by Swiss sexologists and inspired by the groundbreaking work of American sexology, and on their local dynamics of theoretical reclamation and therapeutical translation. The analysed French-speaking Swiss context offers a case of clinical reception, which shows how a strategy of blending therapeutics sheds light to the negotiations at stake in the local usages of the American sexological knowledge.

Sexology, Masters & Johnson, Switzerland, Therapy, Psychoanalysis

065. Going Healthier in peripheral European cities and non-European cities: exploring new connections in urban spaces and resources

The Estrela Garden in Lisbon: Horticultural delights for pleasure and education of the people

Ana Duarte Rodrigues, Faculdade de Ciências da Universidade de Lisboa

The Garden of Estrela, inaugurated in 1852, was the first public garden in Lisbon cheered by its inhabitants where for more than a hundred and sixty years Lisboners enjoy a peaceful leisure setting. My argument is that its success, in contrast with the failure of the Passeio Publico built by the Marquis of Pombal in 1764, relied mostly on its educational role. On one hand, species were continuously introduced in the garden to attract visitors to see new botanic delights or exotic animals arriving from other parts of the world, on the other hand, the first kindergarten established in 1882 – the Froebel's School – added an educational role to its utility as a public garden. To emphasize the importance of botanic and horticultural education in the Estrela Garden, I will discuss the particular features of its kindergarten where gardeners were hired as educational auxiliaries.

Public Garden, Horticultural Exotics, kindergarten, education, citizenship

Gardens for the People. Republican Hygienist Policies for the Working Class

Ana Simões, CIUHCT, University of Lisbon

Maria Paula Diogo, CIUHCT, NOVA- New University of Lisbon

In the early 20th century, and within the growing assertion of Republican ideals, the wellbeing of the working class became a relevant discussion topic among Portuguese intelligentsia. The topic of workers' welfare, which was a political-driven issue for anarchists, Saint-Simonians and Marxists was discussed by scientists and engineers as both a question of physical and moral health. In this context, gardens and parks were central pieces in promoting a healthy lifestyle among the working class, encouraging outdoor activities both for children and adults and substituting the traditional male form of sociability based on the taberna (pub) by a more family-driven type of conviviality. This reform of

the (sub)urban landscape went along with the building of new airy neighbourhoods, free from diseases, and particularly from tuberculosis. In this talk, we discuss (sub)urban projects for working class neighbourhoods in Lisbon in the early 20th century, some meant to be implemented and others belonging to the realm of utopias, including the techno-scientific utopias of the writer and journalist of socialist leanings Fialho de Almeida and the engineer of Saint Simonian inclination and port expert Melo de Matos. By contrasting them with Ebenezer Howard's post-Victorian garden cities, we highlight specificities of a capital city of a weakly industrialized country of the European periphery.

Science in Lisbon, working class neighbourhoods, republican regime, utopian cityscapes, peripheral capital city

Water management in S. Paulo, 1850-1920

Denise Bernuzzi de Sant'Anna, PUC-SP

This talk analyzes some of the relations between the use of water in the city of São Paulo and its dwellers between 1850 and 1920. From the old rivers, fountains and public fountains to the foundation of Companhia Cantareira, a culture of waters involves and characterizes life in the city of São Paulo, marking social disputes and alliances, besides disclosing hygiene concepts, some of which cannot be seen nowadays in city daily life.

culture of water, hygiene, history of S. Paulo

A scream in the park: Hygienism and technological fun in Lisbon and Barcelona

Jaume Valentines-Álvarez, CIUHCT, Nova University of Lisbon

During the first decades of the twentieth century, the mechanical rides that made Coney Island famous were also part and parcel of public parks in Southern European cities. The roller coaster's mechanical clink-clonk and the technology-induced screams and laughs could be widely heard in urban green spaces designed to be quiet and peaceful. However, technological fun and hygienist ideology were not at odds with each other; on the contrary, in many occasions both of them were promoted by the same politicians, transport companies, tourist agents and high-rank engineers. By analyzing Iberian amusement parks such as the Saturno Park in Barcelona and the Luna Park in Lisbon, this paper will analyze how entertainment through mechanical devices and leisure in engineered environments were the two sides of the same coin.

Amusement parks, urban science, social engineering, Iberian Peninsula

Therapies for a "città dolente": in between the wounded Lisbon and the white-city of health during the dictatorship

José Avelãs Nunes, CIUHCT - University of Lisbon

The relationship between hygiene, architecture and the city of Lisbon is explored in this talk focusing on health policies and the agenda of the dictator Salazar. Using whenever necessary a comparative approach, I address the transformations undergone by Lisbon meant to transform it from a dirty,

polluted and infested city into an “hygeia” polis focusing: on the impact of tuberculosis, the discussion between hospitals and sanatoria as adequate places for the contention of epidemics, their impact in changing the urban landscape, the interactions between architects and physicians in affirming the professional status of architecture and medicine, and their role together with politicians in decision making at the level of architecture and at the urban scale.

Estado Novo; STM; Architecture; Sanatoria; Tuberculosis

066. Blood, Food, and Climate: Historical Relationships Between Physiology, Race, Nation-building, and Colonialism/Globalization

The physiology studies and scientific exchange in the Anthropology Laboratory at National Museum of Rio de Janeiro (1910s-1920s)

Adriana T. A. Martins Keuller, Museu de Astronomia e Ciências Afins

The main purpose of this study is to reconstruct the physiological studies developed at the Laboratório de Antropologia (Anthropology Laboratory) during the 1910's and 1920's in the XXth Century at the Museu Nacional do Rio de Janeiro (National Museum of Rio de Janeiro), dedicated to natural sciences. Driven by Medical Doctors/Anthropologists like Edgard Roquette-Pinto among others, the investigations performed there reveal the dynamic of the borders between Laboratory and Field Sciences, its the new evolving meanings as they travel, and its fit into modern experimental science framework. The investigative agenda involved plants, animals and human bodies, and it was related to the current Anthropology concept aligned with the debate of Nation construction at the time. The physiological studies amplified the scientific exchange with different institutions, emphasizing cultural exchange between Brazil and Paraguay, and the role played by Edgard Roquette-Pinto in Paraguay as he inaugurated the Physiological course at Medicine College at University of Asunción.

Physiology; history of anthropology; National Museum of Rio de Janeiro

Fertility and the moral wisdom of the body

Antonello La Vergata, Dipartimento di Studi linguistici e culturali, Università di Modena e Reggio Emilia

Fertility (or fecundity, as the terms were not clearly distinguished until the 1860s and the distinction was not definitely established until the 1930s) has generally been considered a blessing. This is certainly due to the fact that having many children has been necessary in contexts of high mortality. But, for centuries and until recently, “prolificness” has also been charged with moral as well as physiological and social value: she/he is fertile who is not only healthy but also virtuous. Health and morality went hand in hand in a vast medical literature until the middle of nineteenth century (and even later), and their association was a common assumption in the debates on population, poverty, urbanization, pollution. Economic, social and environmental causes were put on a par with physiological causes, and doctors dispensed dietary as well as moral advice in order to counter infertility, the latter being seen as both a cause and a consequence of what Malthus infamously called “vice and misery”. Virtuous habits were as important as fresh air, temperance, moral exertion and “normal” sexual behaviour. In a sense, many of the arguments which characterised the fin de siècle debate on degeneration were a mere refurbishing, in updated, hereditarian terms, of ideas and

ways of thinking operating as early as the eighteenth-century within a conceptual framework which could be described as a naturalised theodicy, or a moralisation of the body.

Fertility; fecundity; physiology; health; morality

Blood, Race and Indigenous peoples in 20th century extreme physiology

Vanessa Heggie, University of Birmingham

In the first half of the twentieth century the attention of American and European researchers was drawn to the area of extreme physiology, partly because of expeditions to the north and south poles, and to high altitude, especially Everest, but also by global conflicts, fought for the first time with aircraft, and involving conflict in non-temperate zones, deserts, and at the freezing Eastern front. In an attempt to help white Euro-Americans to survive in extreme environments, physiologists, anthropologists and explorers studied indigenous people's bodies, cultures and technologies. This paper will examine the science of (white) survival in three extreme environments: the Antarctic, high-altitude, and the Australian outback. It will consider the ways that various indigenous populations were studied by (or in some cases ignored by), and contributed to, Western scientific expeditions and experiments. With a particular focus on blood – in its symbolic (hereditary) and literal sense – comparing these three environments shows how assumptions about indigeneity, nationality, civilization and evolution shaped the ways white Westerners understood their own bodies as well as those of the peoples they encountered in cold, high and hot places.

physiology, race, mountaineering

Heredity and Environment. The Concept of Degeneration and the Early Italian Eugenics (1889-1911)

Giovanni Cerro, Fondazione Collegio San Carlo di Modena

This paper focuses on how the concept of degeneration was treated by the early Italian eugenics movement. The period examined falls between two important dates – 1889 and 1911 – and thus concentrates on the period before Italy's participation in the First International Eugenics Congress in London (1912), and the institutionalization of the movement (1913). In 1889 the anthropologist and psychologist from the University of Rome, Giuseppe Sergi, friend of Francis Galton, published an important work entitled "Le degenerazioni umane", the first Italian text on eugenics. Sergi defined degeneration as an incomplete adaptation to the environment due to hereditary causes and low resistance of the human body to external conditions. Degeneration was thus a pathological state that needed to be treated both with repressive measures (constraint in the workplace, deportation to a desert island, and ban on marriage), and with hygiene and social medicine. Twenty years later in 1911, another book entitled "Le degenerazioni umane" appeared, written this time by the psychiatrist Pietro Petrazzani, vice director of the Institute San Lazzaro of Reggio Emilia. Unlike Sergi, Petrazzani emphasised the difference between degeneration and illness: the first was due solely to external causes; the second was linked to the individual's genetic patrimony. Eugenics therefore had to focus above all on eliminating potentially degeneration-inducing environmental factors, with care in maternity and infancy and correct sexual education. In the twenty years between the two publications we witness a decisive transformation. In the early twentieth century the cause of degeneration was even more frequently sought in environmental factors rather than in hereditary

ones. The entire future history of Italian eugenics rests precisely on this constant oscillation between hereditary factors and the environment – with a clear preference for the second.

Eugenics; Degeneration; Heredity; Environment

Blood, Nation and Race: social and scientific approach on sickle cell disease in Twenty Century Brazil

Juliana Manzoni Cavalcanti, Casa de Oswaldo Cruz

During the 1940s, Brazilian physicians formulated the hypothesis that sickle cell disease would decrease with racial mixture, based on results that indicated a higher incidence of the disease in people with darker skin color. At this period, the whiteness ideology was disseminated in Brazilian society, expressed by cultural preferences and politics. The notion that white blood would improve the life of the blacks affected by a hereditary disease perhaps contributed to lead SCD out of debates about health issues, since the enduring process of racial mixture in Brazilian society would resolve it. The racial mixture frame of sickle cell disease's interpretation in Brazil acquired great audience in Latin-America and contrasted with the idea disseminated in USA in the 1930s and 1940s that racial mixture would raise SCD's incidence. The interpretation of sickle cell disease in Brazil has always been connected with race since its origins in the sharp debates of Nation-building in the 1940s and 1950s. Even when studies, mainly supported by UNESCO, began to dismantle the concept of harmonious race relations in Brazil, physicians continued to see it as an advantageous event in contrast to USA context. Until now medicine and public debates are reticent to recognize racism in medical care, but sickle cell disease's assistance and visibility has been the center of a great mobilization from patients and social movements since the 1980s.

Sickle cell disease, racial mixture, Brazil, Nation-building

Menstruate, Chocolate and Climate. The Physiology of the spanish women in the New Spain (XVI-XVII centuries)

Rosa Angélica Morales Sarabia, Universidad Nacional Autónoma de México

The impact of climate on the physiology of Spanish women was registered in the medicine treatises printed in the late sixteenth century and the first decades of the seventeenth century in New Spain. For these doctors, women presented changes in their food choices (poor diet or overeating) or in the usage of their free time so different from their hometowns, which affected the functioning of their organisms. Their bodies were exposed to external influences, remaining subdued to non-natural "entities" (food, immediate environment, exercise, excreta, sleep and venereal entities). From the physicians' paradigm the imbalance of any of these entities could produce disease. Under the imprint of the gender conditions and covered under the consequences of the climate, the medicals reinforced doctors the thesis on the proclivity of the female body to succumb to the demands of their uterus and of their menstruation. Said this, in this presentation I will analyze how the colonization also became a physiological and mental experience, because the nature of the new world was breathed, ate and absorbed through the skin. For this, I will analyze medical and surgery texts printed in the New Spain.

Menstruate, Chocolate, Women

Chicha as a Chemical, Medical, and Social Problem: the Mobile Boundaries of an Object of Scientific Inquiry

Stefan Pohl-Valero, Universidad del Rosario

After the murder of Colombian politician Jorge Eliecer Gaitán in 1948, and the civil violence that this event produced, some doctors declared that the origin of this civil war was mainly related to a pathological condition of the poor people caused by the consumption of a traditional alcoholic beverage called chicha. 60 years early, chichismo was coined as a local disease. Some physicians argued that chicha, made out of maize, produced during her fermentation a chemical toxin that had several physiological effects. Physical, moral and intellectual degradation were thus characteristic to a person with this disease. In 1949 a new law was implemented by Jorge Bejarano, the ministry of hygiene, which in the practice banned the production and sale of this artesanal beverage. According to Bejarano, the chemical analysis of chicha made in 1889 was, still in 1949, the main argument to banned this beverage and thus stop the physiological degeneration of poor people and the social unrest that the country was living. Nevertheless, in 1937, Bejarano was involved in a public debate where some chemists argued that chicha should to be considered as a food that allowed poor people to increase their caloric and vitamin intake. In this occasion, Bejarano stressed that for the “social problem” of chichismo, “chemical arguments could not guide hygienic and social criteria”. In this paper I am interested in tracking how chicha and the body of its consumers became objects of scientific inquiry, and how their existence -the various realities that acquired these objects- forced to define and negotiate epistemological, disciplinary and authority boundaries among scientists engaged in studying the social milieu. These historical actors, while studying health problems related to chicha consumption and discussing regulatory strategies to try to produce modern citizens, also negotiated the relationship and scope of chemical, hygienic, clinical, statistical, biological, and social arguments for addressing these issues. What was at stake, in a context of incipient scientific specialisation, was to establish what kind of knowledge and experts had the authority to define social problems and how they should be managed. Analysing the negotiations present in the “expert” study of chicha can help us to overcome the idea that there was a homogeneous field, “modern scientific knowledge”, which structured the way of approaching and intervening the social from a single perspective.

Nutrition; Physiology; Boundary work; Governmentality; 20th century Colombia

067. 21st Century Challenges For History Of Science And History Of Medicine Journals

History of medicine journals and the digital humanities

Graham Mooney, Johns Hopkins University

Recent developments in the digital medical humanities present both problems and opportunities for history of science and history of medicine journals. Text and data mining of historical medical and scientific publications, 3-D visualisations of medicalised spaces, and the use geographic information systems (GIS) and story mapping to spatialize historical topics, are becoming increasingly popular in both research and teaching. Apart from publishing reviews of online resources and websites, journals in the discipline have yet to find an effective way of incorporating these developments in dynamic ways that provides stimulating content for the user on the one hand, and appropriate credit and recognition for the creator(s)/author(s) of that content on the other hand. This paper highlights some

of the issues at stake and argues that history of science and history of medicine journals should be more proactive in hosting digital content.

medical history; digital humanities; journal publishing

Centaurus: an International History of Science Journal with a European Brand

Ida Stamhuis, Vrije Universiteit Amsterdam

All members of the ESHS have free access to Centaurus, the official English language journal of the European Society for the History of Science (ESHS). Annual calls for proposals for special issues result in two special issues per year. The editorial board has a special interest in topics connected to Europe as a distinct regional and cultural space. Attention is paid to the approach developed and still developing in circles of STEP (Science and Technology in the European Periphery), a network of scholars with a special interest in the historical study of science, technology, and medicine in contexts regarded traditionally as peripheral. In my presentation I will discuss in which way and to which extent Centaurus enriches the scholarship in the history of science community, in Europe, and beyond.

Centaurus, ESHS, STEP

Open-access and multi-lingualism: 10-year experience

Luciana Costa Lima Thomaz, CESIMA/PUC-SP

Silvia Waisse, CESIMA/PUC-SP

In 2006, there were very few open-access journals specialized in history of science, technology and medicine (HSTM), while the cost of subscriptions makes access difficult to scholars in many parts of the world. To fill this gap was the main reason behind the creation of Circumscribere: International Journal of History of Science, hosted by Center Simão Matthias of Studies in History of Science (CESIMA), PUC-SP, São Paulo, Brazil. To further the goal of making research available to as many researchers and interested readership as possible, by editorial policy authors can submit contributions in English, French, Portuguese and/or Spanish. The selected platform (OJS/SEER) allows publishing multiple versions of one and the same paper. In addition, electronic publishing has additional features, like enabling large and color figures, appendixes, etc., which give more freedom than standard printed publishing.

After ten years, the journal consolidated and we can contribute with some data of interest. About 40% of authors are non-Brazilian; only 7% of papers deal with HSTM in Brazil. A very small number of authors chose to publish in more than one language, being English the most favored, followed by Portuguese. In agreement with international trends, we proactively advertised with graduate programs in Brazil and abroad, including a special section for dissertation abstracts. While we believe that this policy would contribute to make graduate work more widely known, this call practically arose no interest. Authors tend to make limited profit of the possibilities afforded by electronic publishing, mainly inclusion of a large number of figures.

Circumscribere is a part of PUC-SP portal of journals, which manages aspects like standardization (CrossRef, metric tools, etc.) and divulgation via social networks, the latter being one of the latest resources currently explored by scientific publication as a whole.

Open-access journal; HSTM; multi-lingualism

Achievements and Challenges of History of Science journals in Brazil

Marcos Cueto, Casa de Oswaldo Cruz, Fiocruz

Since the 1990s, the number of Brazilian history-of-science journals, and articles published in these journals, have increased. However, these journals differ on how they deal with the challenges of financial sustainability, professionalization, and internationalization. In terms of financial resources, there is a strong tradition on relying on public agencies (funded by federal and/or state governments). This tradition has had remarkable achievements like the Brazilian full open-access system. However, with the mounting economic and political crisis in Brazil some of the financial problems faced by editors are becoming more acute. In a moment of drastic governmental cuts for science, it has been necessary to launch a political struggle to maintain and increase the official resources devoted to history. It is also been an opportunity to raise the issue of how authors, scientific communities and private donors could/should support the continuity of the Brazilian open-access model of academic publication. In the second place, professionalization has been precarious. For example, the staff and recognition of most editorial teams is small. In addition, authors pay little attention to the preparation of manuscripts and tend to dismiss work as reviewers of manuscripts and book reviewers. The latter is the result of an official science system that does not recognize academic review as academic work. In terms of international visibility and impact there has been misplaced expectations that translating more articles into English and attracting foreign authors would be easy solutions. This paper will discuss these problems concentrating on the innovative responses tried by *História Ciência Saúde Manguinhos* during the past few years.

Brazil, journals, history of science, history of medicine

Publication Trends in the Journal of the History of Biology

Michael R. Dietrich, University of Pittsburgh

I will discuss publication trends in the Journal of the History of Biology over the past fifty years using information from a topic model produced by Erick Peirson. I will also consider future prospects for the journal both in terms of its content and in terms of authorship and open access.

history of biology, publishing, journals

Scientific Publications in Latin America: the case of SciELO

Roberta Cardoso Cerqueira, Fundação Oswaldo Cruz

Scientific journals are important for communicating the findings of scientific research. During the 20th century, academic journals consolidated their position as main channels for the dissemination of scientific production.

With the advent of internet, scientific journals have gradually changed over the last two decades, affecting the way articles are submitted for publication and allowing the growth of publications that only exist online. In this same period of time, there has also been a trend towards the incorporation of scientific journals by big publishing houses, especially in the USA and Europe. In the digital era, publishers like Reed-Elsevier and Springer have taken the lead in the realm of scientific publication.

In Latin America, the open access movement drove the creation of the SciELO portal, which has had a great impact on how scientific production is communicated in the region, to the point of becoming a historical landmark in the field of scientific publication in Latin America. Established in 1998, SciELO is maintained by Fundação de Amparo à Pesquisa do Estado de São Paulo (FAPESP), a São Paulo - based funding agency. It was originally created to provide a showcase for scientific production in Brazil, but over time it has gradually incorporated journals published in 15 countries – Portugal, Spain, South Africa, and countries from Latin America and the Caribbean. The articles published on the portal are gold open access. The way Latin American scientific production is funded is very different from the format in North America and Europe. In Latin America, journals depend on governmental support, since there is no tradition of private donations for their maintenance.

In this paper we discuss the challenges of scientific publication in Brazil, with a special emphasis on journals of the humanities and history, and the challenges of maintaining their open access policy and developing the SciELO project.

Scientific journals; Open Access; SciELO

Rethinking academic publishing – a funder's perspective

Simon Chaplin, Wellcome Trust

In the past two decades a third actor has complicated the traditional binary researcher/publisher relationship. Research funders, whether independent foundations such as the Bill and Melinda Gates Foundation, or public funding agencies such as Austria's FWF or the US National Institutes of Health, have begun to impose their own requirements on how research outputs are published. Initially confined to journal articles, in some cases this now extends to books and book chapters and even to underlying data sources. Balancing the desires of funders, the commercial imperatives of publishers and the interests of researchers is a complicated process. This paper will explore the motivations for reform of academic publishing as they have applied at the Wellcome Trust, an independent charitable foundation which supports research in the health-related sciences, social science and humanities. It will discuss the political and practical development of Wellcome's Open Access policy; the creation of a new science journal, eLife (in collaboration with the Howard Hughes Medical Institute and the Max Planck Society) and the most recent creation of Wellcome Open Research, a funder-centric publishing platform developed in conjunction with F1000.

"open access"; "publishing"; "research funding"

Special journal issues and electronic publishing

Soraya de Chadarevian, University of California Los Angeles

Special issues of journals provide an attractive possibility to publish a coherent set of essays on a common topic. They arise from shared discussions, conference sessions or workshops that bring together scholars working on related issues. While each essay should be able to stand on its own, the whole is designed to be more than its parts. Issue titles, introductions by the editors, commentaries and internal cross-references contribute to these aims. Yet the way articles are published and accessed online means that much of the work invested into assembling the whole gets dispersed and is made invisible. While this may lead one to bemoan the loss of the bound issue and its physical unity, it can also initiate a reflection on how the digital medium might be used to enhance rather than fragment the

content of an issue. More generally, it opens the discussion what a journal represents and which of its features we want to preserve in the brave new world of electronic publishing.

"special issues"; "journals", "electronic publishing"

What has been lost and what is gained by electronic publishing?

Staffan Müller-Wille, University of Exeter

Since its inception in 1979, the journal *History and Philosophy of the Life Sciences* had been printed and distributed by Giannini Editore, a family-owned publishing house in Naples, which in 2005 in a time of crisis for the journal the role of publisher. Despite this long-standing service, in 2013, the Stazione Zoologica in Naples, which owns the title, decided in consultation with the editorial team to switch publisher and signed a contract with Springer. The reason for this was not discontent with the service provided -- the journal partly built its renown on paper quality, beautiful layout and excellent copy-editing coo-ordinated by Managing Editor Christinae Groeben -- but the brute fact that submission numbers were dropping since a small publishing house cannot offer the open access options most funders are now demanding and be part of the consortia deals that university libraries rely on nowadays to populate their libraries with online journals. Working with Springer now in my third year I want to discuss what has been lost -- direct and personal contact, for example, with the production team -- but focus on what has been gained. Electronic publishing, from my perspective, offers two advantages: the ease with which an archive of manuscript versions and transparent editorial decisions can be created; and new forms of organizing journal content, such as continuous article publishing, which frees editors from the pressure of "issue building" and offers them great potential for innovative formats.

history of science journals, online publication, distribution

068. Economic Growth, Science and Technology in National or/and Global Contexts: 18th-21st Centuries

The Bahia Pioneering in the manufacture of influenza vaccines during the 1950 decade

Amilcar Baiardi, UCSal-UFBA

Guilherme A. Vieira, UNIFACS

Alex Vieira dos Santos, UNIFACS-SEC-ACB-UFBA

The objective of this work is to focus on the scientific development and R & D abilities in Bahia, in the early fifties of the last century. These achievements made it possible to pioneer the isolation and development of autochthonous vaccines adapted to the environment and to the strain of the virus responsible for the Korean and Asian flu epidemic, which afflicted Brazil and Bahia in the period 1951-1957. In the 1950s Bahia presented a scenario of modernizing public changes, marked by several interventions, initiated under the administration of Governor Mangabeira. Among them was the creation of the Biological Institute with the scientific leadership of Fúlvio Alice, adequate infrastructure for research in virology and a pilot plant with the capacity to manufacture vaccines. Additionally, there was the creation of the Bahia Foundation for the Development of Science which would be the first state agency to support research in the country as the result of the conception of the educator and social scientist Anísio Teixeira. With infrastructure for research and project costing,

it was possible to isolate viruses and manufacture the vaccines through a scientific-technological route that provided for the culture and isolation in chick embryos, a procedure that proved to be more effective than inoculation in mammals.

"Research and Development" "Vaccines" "Bahia" "History of Science"

The intricacies of technodiplomacy and technopolitics in the railways of Mozambique (1870s-early 20th century)

Bruno José Navarro Marçal, Interuniversity Centre for the History of Science and Technology
Hugo Silveira Pereira, CIUHCT - FCT/UNL

In the 1870s Portugal tried to increase her presence in the colony of Mozambique by reinforcing her alliance with Great Britain and by building railways towards the frontier with the neighbouring British colonies and Boer Republics.

In Southeast Africa, Portugal was the ruler of a large stretch of land (Mozambique) that had at least to good harbours: Beira and Lourenço Marques (Delagoa Bay) that could serve as outlets for the production of the territories beyond Mozambique's frontiers. To tap into the wealth of those regions Portugal needed railways.

The discovery of gold and diamonds in the Transvaal (a landlocked country, which closest sea exit was precisely Lourenço Marques) and the development of the British territories of Rhodesia and Nyasaland (two other landlocked territories very close to the port of Beira) increased the value of the Portuguese possessions in Southeast Africa. Railways became a dire need not only to serve the transport needs of the internal colonies/nations but also to serve as an asset in rendering undisputed the sovereignty of Portugal over Mozambique.

In this paper we will analyse the process of railway building in Mozambique (namely the Lourenço Marques, Beira, Swaziland and Nyasaland lines) using Hecht's concept of technopolitics, Schweitzer methodology of technodiplomacy, and Faye's analysis of cross-borders. We will read on sources produced by the Portuguese and British Foreign Office and technical reports of the Portuguese engineers. We hope to contribute to the general discussion about the relation between technology and politics/diplomacy and between technology and national frontiers.

"Portugal", "Colonial History", "Railways", "Angola", "Mozambique"

The "Entrepreneurial State" and the public sector's role in generating biotechnologies for health: the case of the Brazilian State

Erika Santos de Aragão, Universidade Federal da Bahia
Mauricio Lima Barreto, Centro de Pesquisa Gonçalo Moniz - Fiocruz

There is a widespread debate in the capitalist economy regarding economic development, particularly in regards to the State's greater or lesser involvement. This is a pendulum debate and the economic policies adopted in any specific context result from a hegemonic perspective. The question is whether the State should take on what many assume to be the role of the market (as certain countries did following the Second World War in health, education, etc.) or only operate in relation to its proper functioning (as a regulatory agent), a perspective particularly apparent from the 1980s onwards. In the latter case, this means taking on the risks that the private sector is not willing to assume. However, when one observes the role of the State in relation to innovation generation, despite what many suggest, certain theorists posit that it plays a central role as an entrepreneurial

agent. This argument has been developed by Mariana Mazzucato (The Entrepreneurial State, 2013). The author argues that government investment was responsible for the foundations for the creation of the new technological trajectories and paradigms that have driven economic growth and enabled the rise of large transnationals such as Apple. These made use of the results of American state-funded research, attaining record levels of profitability and market participation. In other words, the author argues that risks were socialized and rewards were privatized. This phenomenon is also widespread in the area of health, in particular in biotechnology. In developing countries, in which private institutions generally take on even less risk, as observed in the low percentage of investment in R&D, this may be translated into an increase in inequality of access to these technologies. In order to contribute to these reflections, we seek, in this work, to identify the participation of the Brazilian State in health biotechnologies and the results in terms of innovation. The, still partial, results suggest that investment in R&D in general has been converted into innovations appropriate for the private sector. However, if constitutional and legal precepts are established, which define a model in which public health institutions work not only in research but also in development and production, such appropriation may be converted in order to benefit Brazilian society through the Unified Health System (Sistema Único de Saúde: SUS).

Entrepreneurial State; Brazil; biotechnologies; economic development; public health

Evolution of the ironmaking furnace internal profile at Fabrica de Ferro de Ipanema

Fernando J. G. Landgraf, Universidade de São Paulo
Paulo Eduardo Martins Araujo, UNICAMP
Jefferson de Lima Picanço, UNICAMP

In October, 2015, researchers from Universidade de Ferrara (Italy) and Universidade de São Paulo laser scanned the exterior and the interior of the ironmaking furnaces of Fabrica de Ferro de Ipanema, which operated from 1817 to 1926. They are blast furnaces built with stones and bricks from the Araçoiaba Mountain, where the iron ore also came from. The laser scan records the last stage of the transformations by which the 8 meters high furnace profiles of the 3 standing furnaces were subjected. They were built by Luis Frederico Varnhagen in 1817, first operated in 1818. There are at least six drawings made along the XIX century describing the inner profile of the furnaces. The profiles were modified by the several directors along the period, aiming at the improvement of the furnace productivity, evaluated by the systematic control of the charcoal consumption per ton of pig iron. That type of analysis was present in the specialized European literature of the XIX century, which indicates that the Brazilian directors were acquainted with the technical and scientific procedures of the time, recording the existence of a Brazilian Metallurgical engineering in action.

archaeometallurgy; engineering; metallurgy; ironmaking in Brazil

Confronting the global economic crisis: the 1930 inquiry about the financial resources of science

Gabriel Galvez-Behar, Université de Lille - SHS

The relationship between science and economic growth can not be understood unequivocally. The economic environment also plays a fundamental role in the development and in the organization of science. Thus the role of science in economic history has to be analyzed as well as the role of economy in the history of science. In a way, this paper tends to contribute to an economic history of

science, which is necessary to understand recent evolution of the scientific field.

Our purpose is to highlight how the scientific community can face its economic environment and more precisely economic crisis. It specifically deals with the 1930s economic depression and it analyses how some scientists tried to establish, at an international level, a statistical framework of accounting the financial support of research in the world. This inquiry, which took place in the very early 1930s, is probably one of the first to be managed by an official international organization – the International Institute for Intellectual Cooperation –, where famous scientists like Marie Curie or Robert Millikan played an important role. It will be considered in a larger history of the statistical works about science from the early 20th century to the adoption of the Frascati Manual (1962).

science policy, economic crisis, statistics, 1930s

Science and technology policies in Meiji Japan and Porfirio Díaz's Mexico: a comparative perspective

Gerardo Tanamachi Castro, Liceo Mexicano Japonés, A.C.

Despite their distinct history and cultural traditions, Japan and Mexico underwent a period of similarly huge transformations aimed at modernization, beginning in the last third of the nineteenth century. The Meiji Period (1868-1912), under the slogan “bunmei kaika” (civilization and enlightenment), followed more than two centuries of isolation as a country. The rule of Mexico by Porfirio Díaz (1876-1911), under the slogan “order and progress”, was the first politically stable period after more than three centuries of Spanish domination. Nevertheless, quite different science and technology policy projects were conceived to foster industrialization, one of the main goals in both nations. This can be noted in aspects like the selection of foreign advisors and their working conditions, the students abroad program, the way in which a national university was established assembling existing institutions, the research facilities founded and supported fields of study, the management of natural resources, and the relation between private industry, government offices, and educational institutions. In general, the Japanese science and technology system turned to be bigger, more diversified, rather nationally controlled, and with a better integration to the private sector, compared to the Mexican one. It is clear that other factors, such as social inequalities, financial resources, and literacy rates, were influential in the outcomes of these policies, but the differences between them constitute an important background for understanding the contrasting situations of both countries even nowadays.

Science and Technology Policy; Comparative Studies; Japan; Mexico

The intricacies of technodiplomacy and technopolitics in the railways of Mozambique (1870s - early 20th century)

Hugo Silveira Pereira, CIUHCT - FCT/UNL

Bruno José Navarro Marçal, CIUHCT - FCT/UNL

In the 1870s Portugal tried to increase her presence in the colony of Mozambique by reinforcing her alliance with Great Britain and by building railways towards the frontier with the neighbouring British colonies and Boer Republics.

In Southeast Africa, Portugal was the ruler of a large stretch of land (Mozambique) that had at least to good harbours: Beira and Lourenço Marques (Delagoa Bay) that could serve as outlets for the production of the territories beyond Mozambique's frontiers. To tap into the wealth of those regions

Portugal needed railways.

The discovery of gold and diamonds in the Transvaal (a landlocked country, which closest sea exit was precisely Lourenço Marques) and the development of the British territories of Rhodesia and Nyasaland (two other landlocked territories very close to the port of Beira) increased the value of the Portuguese possessions in Southeast Africa. Railways became a dire need not only to serve the transport needs of the internal colonies/nations but also to serve as an asset in rendering undisputed the sovereignty of Portugal over Mozambique.

In this paper we will analyse the process of railway building in Mozambique (namely the Lourenço Marques, Beira, Swaziland and Nyasaland lines) using Hecht's concept of technopolitics, Schweitzer methodology of technodiplomacy, and Faye's analysis of cross-borders. We will read on sources produced by the Portuguese and British Foreign Office and technical reports of the Portuguese engineers. We hope to contribute to the general discussion about the relation between technology and politics/diplomacy and between technology and national frontiers.

Technopolitics; technodiplomacy; railways; Mozambique; Portugal

Trading the Newtonian Science in Eighteenth-Century England – The Trajectory of Benjamin Martin as Itinerant Lecturer and Scientific-Instrument Maker

Luiz Carlos Soares, Universidade Federal Fluminense

Benjamin Martin was one of the greatest propagandists of Sir Isaac Newton's Natural and Experimental Philosophy, mainly through the numerous courses of lectures he had given in many provincial English cities from the late 1730's up to the early 1750's. Martin attracted a diversified clientele to his courses of lectures with efficient advertisement in which his publications (textbooks and treatises) played an important role as means of divulgation of his professional activities. These publications were sold by himself, during his travels to the interior of England, or by authorized booksellers.

If John Theophilus Desaguliers was the most recognized Newtonian lecturer and philosopher between 1730 and 1740, the same could be said of the mathematician, optician, inventor, itinerant lecturer and scientific-instrument maker Benjamin Martin in the mid and late eighteenth century. Martin had a long life according to the life expectancy of the time (from 1704 to 1782), and was fortunate for having his works published and recognized by the public in the middle of the century, at the peak of the Enlightenment (in Great Britain and Continental Europe) and an age of great interest for Mechanical and Experimental Philosophy and the Applied Science inspired by Newtonian theory, especially in England. From the 1750's until his death, Martin established himself as an important mathematical and scientific instrument-maker at Fleet-Street, London, manufacturing and selling many of his inventions and improvements. Among them, were several models and sizes of telescopes, microscopes and glasses for correcting the vision.

We can, definitely, give Martin the credit of greatest diffuser of Newtonianism in eighteenth-century England, mainly due to the great diversity of his works, since he wrote either to specialized readers – broaching the technical and complex aspects of his inventions and improvements and the most abstract mathematical and metaphysical foundations of Newtonian theory – and to those beginners who intended to be initiated in this perspective of Natural Philosophy. From 1735 onwards, Martin published several pamphlets and treatises, divulgating his inventions and improvements, and compendiums, textbooks and dictionaries about the most diversified subjects, including Natural Philosophy (Newtonian Physics and Optics), Mathematics, Navigation, Geography, Cartography, Chemistry, Natural History and English Language.

Benjamin Martin, Newtonian Science, England, Eighteenth Century

Itinerant technical knowledge: Marquis of Ureña's journey to France and England (1787-1788)

Marcelo Fabián Figueroa, CONICET

From 1787-1788, Marquis of Ureña traveled from Spain to France and England to collect scientific and technical information on metal, ware and leather manufacturing. This paper examines Marquis of Ureña's travel account which contains profuse descriptions about academies and manufactures. As historians of science and economy have pointed out this travel literature written by itinerant nobles, craftsmen, etc. was a key element of the knowledge economy which emerged during 18th century (Belfanti, 2004; Bertucci, 2007; Jones, 2008; Pérez & Verna, 2009). In this essay, I wish to focus on Ureña's travel account by arguing that Ureña's text could be understood as a well organized inventory of raw materials, techniques, etc. I do this by approaching this travel account that allows me to sketch an aristocratic way of knowledge circulation which was based upon mutual dialogue of scientists, engineers, technicians and noblemen.

circulation-useful knowledge-Spain

Waste as energy: the reunion of man and its basic product

Regina Maria Macedo Costa Dantas, Universidade Federal do Rio de Janeiro

Marcelo Côrtes Silva, Universidade Federal do Rio de Janeiro

Pedro Moreno Feio de Lemos, Universidade Federal do Rio de Janeiro

Hebrew Writings dating back to 3000 years ago already discoursed on the practice of disposing of waste away from their first thorps and the difficulties arising from these practices. Throughout the history of humankind, their social and technological developments not a few moments of conflict between the men and their basic product, residue. The epidemics of the fifteenth century marked a historical time in perfect antithesis between the meaning of life and death that waste translate. The domain of nature exercised by man, subduing it, allied to technological transformations, accentuated by the industrial revolutions, and the fear generated by the production of their own waste, created a dichotomy that marks the social relationship with the waste. The rapid population growth, the progressive urbanization of human society and the economic system that has imposed the consumer society contributed apace for an unprecedented environmental degradation and further environmental awareness from the years 1970. Several signs and environmental movements have emerged, but it was the crisis of energy sources, mainly oil, which hit the spot of attention in society and Governments. More specific public policies and controls have been enhanced as the indiscriminate use of natural resources, new sources of energy were being studied and proposed in order to ensure the domination of nature recasts its foundations, but keeping his severed logic. The developed countries, with the political and capital domain, came out in front in search of cleaner energy sources and waste were the key in this process. The waste acquired a very important status for environmental issues and maintenance of life on Earth. The rate of re-use of residues in developed countries is over 90%. Composting, anaerobic biodigestion, incineration and recycling are among the most common treatment systems because they produce important products and by-products that allow diversification of the energy matrix, preservation of natural resources and reduction of greenhouse gas emissions. Sweden and Germany stand out on the expertise of these systems. With the hypothesis that there is a movement of rewiring between man and its residues, the present work aims to show the doctoral sandwich experience in Linköping, Sweden, examining in details the waste policy in this city and the Swedish relevance in the dissemination of the waste as an energy source and overcoming of environmental ills.

waste; energy; Anaerobic biodigestion; environment

The contribution of science to the sugar industry: the ministries of agriculture in Brazil and Argentina in the first quarter of the 20th century

Roberta Barros Meira, Univille

Daniel Campi, Instituto Superior de Estudios Sociales (UNT-CONICET)

This article intends to analyze the ideas about the creation of a new model of ministry of agriculture implanted during the first quarter of the 20th century in Brazil and Argentina. These ministries give us the plans of the policies directed to the adoption of a scientific agriculture in both countries. The paper raises questions about the advances of agronomic science and its interaction with an increasing state intervention in agriculture. It focuses its analysis mainly in the contrasts and similarities with other producing countries and the consequences of the circulation of knowledge and technologies in these spaces. It also outlines a profile of the growth of world sugar production – either cane sugar or beet sugar – as a decisive factor to the sugar producers' new demands for educational and research institutions in these sugar-related areas. The present work is a first approximation with the process of constitution and operation of a network of technicians from Argentinian and Brazilian sources, such as bulletins and technical leaflets

circulation of ideas; agriculture; science

Relations between pharmaceutical monopolies and biomedical research: an up-to-date reading by Tamás Szmrecsányi

Rosa Maria Corrêa das Neves, Fundação Oswaldo Cruz

We understand the studies of Tamás Szmrecsányi on the methodological need to relate the historiography of science and technology with economic development as an important contribution to give complexity to the history of science. In part of his studies, the first in the sense of interacting an internalismo and a historiographical externalism from the economic point of view, we identify the periodization relative to the first, second and third industrial revolutions as reference for the economic study of science and technology.

In our studies on contemporary science and our professional intervention in the field of scientific education in the biomedical field, we work with the hypothesis that the organization of contemporary biomedical research has relations with the dynamics of pharmaceutical conglomerates continuously concentrated since the 1980, an aspect of the imperialist phase of capitalism, consolidated since the beginning of the 20th century. If our hypothesis is admissible, we dare to suggest that this initial periodization of Tamás Szmrecsányi is not a direct reference for the organization and development of the biomedical sciences and beyond, and that for each science there may be a specific periodization. In spite of a supposed peculiarity in the relations between economic development and specific scientific and technological development, we consider correct the more general relation that the economist proposes between the scientific development and phases of development of capitalism.

Tamás Szmrecsányi; pharmaceutical monopolies; contemporary science; imperialism

The origin and early development of aeronautical standards

Takehiko Hashimoto, University of Tokyo

Large technical systems developed in the twentieth century demanded the establishment of various types of technical standards for their safe and smooth operations. Aeronautical standards is one of such cases which enabled the routine operations of aircraft. This presentation will explore the origin and early development of the aeronautical standards in Europe and elsewhere in the early 20th century. The origin goes back to 1909 when several German airships made forced landings in French territory. The French government immediately recognized the potential and grave risk of new types of flying machines and decided to organize an international meeting inviting representatives of European countries to discuss the matter. This initial effort, however, did not produce any official practical system of aeronautical standards to certify the safety of the aircraft before World War I. After the War, the International Commission for Air Navigation was convened to discuss how to certify the safety of aircraft crossing the national borders. To do so, they set up six technical subcommittees to discuss technical details of relevant important aspects of air navigation. The formation of these subcommittees and technical details discussed there show well the technological system of air navigation. They were not only concerned with the safety of aircraft itself, but also with the ability and health of pilots, adequate provision of meteorological information, standardized use of wireless communication, and so forth. This international aerial convention was established with the notable exclusion of Germany as well as the United States. The United States developed and established its own aeronautical standards under the Ministry of Commerce in 1926. Towards the end of World War II, under the initiative of the United States, the Provisional International Civil Aviation Organization was set up which led to the postwar establishment of ICAO. In this presentation, I will mainly talk on the early efforts to construct the set of international aeronautical standards, and briefly describe contemporary and later developments of aeronautical standards in the United States.

aviation; standard; technological system

Inventions, Technical Innovations and Technological change in Nineteenth century auriferous mining in the Brazilian State of Minas Gerais

Tania Maria Ferreira de Souza, Pontificia Universidade Católica de Minas Gerais - PUC Minas
Isabella A. de Azevêdo Oliveira, UFMG/CEDEPLAR

This paper aims to construct a history of the practice and theory behind the technology in 19th century Brazil and will thus take into consideration the influence of European and American engineering on the Brazilian courses of the era. At this time, the formal education of engineers took place in the most prestigious European Schools of Engineering. This model reached Brazil in the 19th century when mining engineering courses were introduced at the Military School of Rio de Janeiro and at The Ouro Preto School of Mining and Metallurgy (Decree of 06 November 1875). This initiative was a late response to the challenge of creating an economic base for the development of the Brazilian State. The engineers who had graduated from the recently inaugurated universities would thus contribute to regional and national economic reconstruction, in a context in which the Brazilian state and the economic and political elite would make viable the formation of human capital, indispensable for a successful process of industrialization. Besides considering the institutionally significant role of the Ouro Preto School of Mines and Metallurgy, in the gradual overcoming of the technological gap, it is relevant to highlight how such a process was influenced by the intellectual exchange between French, German, English and American scholars and how their knowledge and technical practice was used and adapted in the Brazilian mining economy during the 19th century. In fact, the foreign engineering teachers never simply borrowed ideas or approaches from Europe or

ICHST
2017

United States, but had to adapt and modify the knowledge in order to fit the specific circumstances and demands of Brazil. An examination of the day-to-day mining practice has revealed an interesting dialogue between the technical knowledge, which had been developed and inspired according to the foreign model, and the adaptive ability of the native, the result being a very productive symbiosis. Thus, it is important to highlight the importance of the foreign engineers that came to Brazil in the 19th century and revealed themselves as the vectors of this process of adaptive creation. This significant dynamic in gold mining, studied during post doctoral research, subsequently formed the basis for the present article.

Engineering; Technology; Auriferous Mining; Nineteenth century

Statistique, contrôle, croissance et développement: leçons des mondes coloniaux britanniques et français (XIX-XXe siècles)

Touchelay Beatrice, Université Lille

La comparaison de deux systèmes statistiques distincts mis en place dans les configurations particulières de la colonisation britannique et française depuis le XVIIIe siècle éclaire les relations entre la volonté des Métropoles de « connaître » les territoires, de « mesurer » et d'encadrer leurs activités et leur développement effectif. On oppose souvent la qualité de la statistique coloniale britannique aux approximations de la statistique coloniales française et on les assimile chacune à deux modes d'encadrement des territoires conduisant à des performances économiques inégales. Ces rapides constats sont à étayer. Il paraît en effet difficile de penser que ces deux modèles se développent de façon complètement autonome, n'y aurait il pas plutôt un développement par capillarité, l'expérience de la statistique coloniale britannique influençant celle de l'espace français et réciproquement ? Quels seraient les canaux de cette influence ? Autres questions qui interrogent les transitions et qui nous mènent jusqu'au XXIe siècle : quel est l'héritage du système statistique colonial après les indépendances et quels sont ses effets sur les modes de croissance des pays devenus indépendants ? Quelles sont les leçons tirées de ces relations entre modèles statistiques et croissance pour l'ère post coloniale pour les anciennes Métropoles ? Autant de questions qui interrogent les relations entre la statistique, la volonté politique dont elle est porteuse et le contrôle qu'elle véhicule sur les territoires et plus largement sur les relations entre les États ou les pouvoirs politiques et la croissance via ces instruments de mesure.

statistique; colonisation; Empires français; Empire britannique; Etats

Emma S. & Wladimir S. Woytinsky - a couple in statistics visited Latin America in 1958

Annette B. Vogt, MPI for the History of Science

Emma S. (1893-1968) and Wladimir S. (1885-1960) Woytinsky was a very unusual couple in statistics. They were not only interested in statistics - they published together 2 volumes on statistics of the global world (in 1953 and in 1955) -, they were also interested in economics, economic development and economic growth from an international and from a comparative perspective. In 1958 they visited several countries in Latin America, it was an eight months research and lecture tour. Coming back, Wl. S. Woytinsky published the book *The U.S. and Latin America's Economy* (New York, 1958). Both were interested in a deep understanding of economic growth, and they were curious to investigate the economic development in South and Latin America. Before their research trip Emma S. Woytinsky took courses in Spanish.

In my talk I will scetch out first the biographical background of the statisticians Emma S. and Wladimir S. Woytinsky, Russian-Jewish emigrées, who escaped to the USA in 1935 from Nazi Germany via Paris. Second, I'll describe their research and lecture tour through Latin America in 1958 with a special focus on their interest in the economic development of these countries. Third, I'll analyse their publications related to economic growth. Their approach, the international, comparative, and long-durée approach, is still relevant and could be applied on recent questions on economics.

couple in science - couple in statistics history of economics Latin America's economy (1950s) research and lecture tour investigation on economic growth

069. Visualization as a historiographic tool for historians of science & technology

Uncovering the patterns and morphologies of science evolution — The tribulations of Scientific Fields

David Chavalarias, CNRS

This talk will portray automated methods for the bottom-up reconstruction of the cognitive evolution of science, based on the large-scale analysis of digital libraries, and modelled as lineage relationships between scientific fields.

These lineage relationships constitute a level of observation of science, where its dynamical and multi-scale structures can be characterized both quantitatively and morphologically. I refer to these dynamic structures as phylomemetic networks or phylomemies, by analogy with biological evolution. I will show that phylomemies exhibit strong regularities, with clearly identifiable phylomemetic patterns. For example, some structural properties of the scientific fields – in particular their density –, which are defined independently of the phylomemy reconstruction, are clearly correlated with their status and their fate in the phylomemy (like their age or their short term survival).

The branches of phylomemy can be qualified from the point of view of their morphology, each domain of science having a very specific signature that reflects the main steps and timing of its development. Using few examples that will compare the morphology of phylomemetic branches to the history of the associated field written by its protagonists, we will raise the question of the degree of retrodictability of the phylomemy reconstruction method and how it can be used by historians for heuristic or descriptive purposes.

science evolution ;quantitative epistemology ; text-mining ; socio-semantic networks ; phylomemy reconstruction

4D Visualisation of Social Networks Exemplified by the Foundation and Development of the International Latitude Service at the End of the 19th Century

Andreas Haka, University of Stuttgart

The visualisation of networks is standard within the framework of social network analysis as a central part of the representation of individuals, groups, institutions, etc. Here, in most cases, the composition of and relationships within groups of people at a given time is visually presented as a 2D image. The formats of network graphs used for this purpose are manifold. But the interest of scientists in the analysis of more complex social networks, and also in specific detailed questions, has

been moving meaningful 3D representations increasingly into the focus. Moreover, especially in historical network analysis, a further aspect becomes the focus of attention, namely the question of the dynamics of relationships in a social network over a defined period. Therefore, based on 3D visualisation concepts, the search for appropriate forms of 4D representations capturing the dynamics of networks has become a central object of research in historical network analysis in the historical sciences. In this talk, opportunities, problems and limitations of the 4D visualisation in the context of historical network analysis will be presented, based on the foundation and development of the International Latitude Service at the end of the 19th century.

"4D Visualisation"; "historical network analysis"; "History of the International Earth Rotation and Reference Systems Service"

Bibliometric History of Specialty Structures in the Sciences

François Claveau, University of Sherbrooke

This talk has two parts : one retrospective, the other prospective.

In the retrospective part, I will present a completed project that mapped the history of specialties in economics using 60 years of Web of Science data (10 million references; Claveau and Gingras 2016). This part will focus on the web app located at www.DigitalHistoryofScience.org/Economics/. Our approach has been to construct a dynamic network over the period made of a moving 5-year window. The nodes of the network are articles and the edges are based on bibliographic coupling (i.e., a measure of the overlap of the reference lists of each pair of articles). On this network, specialties are detected with a community detection algorithm (a modified Louvain method). One of our key goals in this project has been to produce a web-based visualization tool that can be used by anyone interested in the specialty structure of economics. I will thus present in some detail our web app.

The prospective part will discuss two crucial elements in the context of our ongoing project about specialties in the social sciences and humanities (150 million references). This project is an extension of what we did on economics. We want to learn from our experience in order to produce even more insightful results. The first element for discussion is the empirical specification of a specialty. Historians (and academics in general) typically think they have an intuitive grasp of what a scientific specialty is, but a moment of reflection is sufficient to realize that the term has multiple meanings. Bibliographic coupling at the level of articles seems a good empirical proxy for one concept of specialty, but it might be preferable to opt for a different concept, closer to the dominant intuitions regarding the term.

The second element in the prospective part is about user experience with the interactive visualization. We want to be useful to scholars, principally historians of science, who are not as attracted as we are to digital humanities. Digital methods in the history of science have the potential to be a great addition in the historian's standard toolbox, but the degree of adoption has not been impressive. Much careful work is thus needed to increase the perceived ease of use and usefulness of our next web app.

Reference

Claveau, François, and Yves Gingras. 2016 (in press). "Macrodynamics of Economics: A Bibliometric History." *History of Political Economy* 48 (4).

Bibliometrics; specialty structure; formal network analysis; text mining; community detection

Leonardo Da Vinci and Al Muradi - Multimedia Virtual archaeology as methodological tool

Mario Taddei, Leonardo3

The talk will illustrate about how modern multimedia & simulation technology can help to study and research the manuscripts of Leonardo da Vinci and Ibn Kalaf Al-Muradi. Mario Taddei will also reflect about how advanced digital reconstructions can become a historiographic tool for historians of science and technology. Bringing old codices to life not only allow us to understand how complex machines were functioning but also lead to new questions and research directions. Presentation of the multimedia Leonardo3 museum in Milan. For Info google: Mario Taddei + Leonardo3. (www.Leonardo3.net)

Leonardo; Vinci; edutainment; research; multimedia

Visualization of Networks of Knowledge. The case of the tract De sphaera during the early modern period

Matteo Valleriani, Max Planck Institute for the History of Science

During the 13th cent., ancient geocentric cosmological knowledge was reshaped in the framework of the process of re-elaboration of both ancient and Arabic scientific knowledge. 13th-century authors produced new treatises entitled The Sphere which were characterized by a new design rather than new content. With one of these treatises, namely Johannes de Sacrobosco's, a new tradition of knowledge began that continued for four centuries. Taking into consideration only the period that spans from the diffusion of printing technology until the end of the 17th century, over 350 editions of Sacrobosco's The Sphere were printed in Europe. The impressive number of prints testifies for a growing audience in and outside the universities all over the continent while the originally short treatise underwent a profound transformation, as it was continuously enlarged and enriched with more and more subjects. The treatise entitled The Sphere of Sacrobosco together with its long lasting tradition therefore represent the virtual place in which a shared scientific identity was shaped over the European continent.

Firstly, investigating how this shared identity was formed, requires analyses that can be best, if not only, executed by means of tools that allow working visually. Beginning with the bibliographic metadata concerning the treatises, it is necessary to explore the distribution of their production over time and space. By means of visualization tools it can be determined, which kind of structure the network of treatises assumed, it helps, for instance, to determine the degree of centralization of the network. Because of the large amount of data, such a step would not be possible without a visualization tool.

Secondly, visualization tools as developed in the frame of the Social Network Analysis are necessary to investigate the multi-layered network that is constituted, on the one hand, by the relations between authors, printers, and further economic and educational institutions involved in the creation, production and diffusion of the treatises, and, on the other hand, by the semantic relations of the treatises. Their content changed in fact over time according to a local-universal mechanism: new subjects were created on a geographic local level and then transformed, for instance through translating into Latin, and distributed by the great hubs all over the network.

The lecture will provide an overview of a series of visualization methods and tools.

The Sphere of Sacrobosco; Knowledge System; Network Theory

Visualization as a Historiographic Tool for Historians of Science and Technology

Klaus Hentschel, Univ. Stuttgart, Head of History of Science & Technology Section

The organizer of the Symposium 69 will cover the following topics:

Why this symposium on Visualiation as a historiographic tool for historians of science, medicine & technology; important goals of historiographic visualizations; providers of massive data for historical analysis; typical maps, plots & diagrams made by historians; problems with historical visualizations of science; non-uniqueness of historiographic visualizations; how to map the temporal changes; how much forecasting of science dynamics is possible?

After a brief summary there will be ample time for general discussion.

historiographic tools; visualization of historical data; methods

Visual representation of a complex oeuvre: The essays and articles of Alexander von Humboldt

Sarah Bärtschi, University of Berne

From 1788 to 1859 the explorer and scientist Alexander von Humboldt published about 800 articles and essays in over 150 periodicals. These texts are written in different genres and for different target groups, published in periodicals spread all over the world, both scientific journals and daily newspapers. And they are multilingual and multidisciplinary. In my talk, I will discuss the combination of quantitative and qualitative methods in order to visualize and describe the complexity and heterogeneity of this corpus. By alternating between distant reading (Franco Moretti, e.g. *Graphs, Maps, Trees. Abstract Models for a Literary History*, New York 2005; *Distant Reading*, London/New York 2013) and close reading, I will try to answer a multitude of research questions: How many articles did Alexander von Humboldt publish per year and over his lifetime? Are there peaks of publication and periods of fewer contributions to journals? Can we link their geographical distribution to other factors? What is the meaning and distribution of translations, textual variants and reprints? Is it possible to determine the specific disciplines in each article and to give an overview of Humboldt's multi-, inter- and trans-disciplinarity? Can we 'measure' and visualize Humboldt's rhetorical strategies, his writing style (e.g. narration versus description), the different genres (e.g. travel narratives, scientific reports) and his use of specific vocabulary with distant reading methods? With several examples I will show how I processed the digital texts to enable these quantitative analyses and visualizations. Some of the visualization tools shown in this talk were developed in conjunction with the graphic designer Fabienne Kilchör (Hochschule der Künste, Bern). I will demonstrate how the text analysis with word clouds, maps, bar charts and with similar quantitative approaches reveal a new and fresh overview of Humboldt's work and how these methods can be applied to oeuvres of other scientists and authors.

Digital humanities, Distant reading, Alexander von Humboldt

Multifaceted Interactive Visual Exploration of Biographical Information of German Engineers 1825-1970

Stefan Jänicke, Leipzig University

The Prosopographic Database of Engineers (<http://www.uni-stuttgart.de/hi/gnt/pdm/index.html>) contains at the moment biographical information about 4,268 engineers who worked at German universities and research institutes between 1825 and 1970. Next to lifetime data, academic title, teaching assignments, assistant positions and memberships in specialized associations, political parties, student associations, etc. are given. The database is of great value as it comprises the key persons of engineering – one of the main pillars of German economy in the 20th century.

We present various visualizations in order to support the investigation of various research questions on this database. First, we introduce a web-based application that allows for the dynamic multifaceted exploration of the engineers' biographical information. Therefore, we provide several visual interfaces that reflect different features. This includes the visualization of temporal (e.g., dates of birth and death, years of teaching assignments) as well as the geospatial data (e.g., places of birth and death, places of teaching assignments), for which we adapt GeoTemCo (<http://www.informatik.uni-leipzig.de/geotemco/>) that provides an interactive map and timeline to comparatively explore geospatial-temporal data. In addition, we make use of tag clouds and pie charts to illustrate the importance of various engineering disciplines and the numbers of academic degrees. All visualizations are linked, so that complex research questions like geospatial-temporal movements of the three engineering divisions materials, assembly and construction can be investigated.

Second, we adapt a profiling method – originally developed for a musicians database (<http://www.profiling-musicians.vizcovery.org/>) – to engineers. The idea is to discover engineers with similar biographies and to compare their features. Three visualizations support this task: (1) a Column Explorer to compare textual information such as disciplines or universities, (2) a social network graph to explore relationships between the engineers of the database, and (3) a map to illustrate places of research positions.

visualization; biographical database; engineers; interactive exploration

070. The Chinese Texts of Sciences and Technologies and the Technologies of Their Books

Leibniz's Manuscript on the Chinese Windmill

Baichun Zhang, The Institute for the History of Natural Sciences (IHNS), CAS
Wenchao Li, Leibniz Universitaet Hannover

In the 17th century, Jesuit missionaries introduced China into European society, which aroused European scholars' interest in this oriental country. G. W. Leibniz intended to seek after Chinese knowledge was worthy to be introduced to Europe. His manuscript indicates a case of the inter-cultural transmission of technology on the basis of limited information. Leibniz relied on Nieuwhof's landscape painting to have a little understanding of the Chinese vertical-axle windmills that drives the square-pallet chain-pump in pre-modern China. He analyzed the structure of this kind of windmill. It seems that he noticed its advantage: it can by itself adjust the direction of the vanes when it turns. He tried to improve European windmills, so that he designed a special vertical-axle wooden windmill that can by itself adjust the direction of the vanes to drive the Archimedean screw. Leibniz paid importance to the complementarity of knowledge in different cultures, and asked a Jesuit to further investigate the Chinese windmill.

Leibniz; Manuscript; Chinese Windmill

Huaxue Kaozhi: The Qing Dynasty's First Textbook of Qualitative Chemical Analysis

Hao Chang, I-Shou University

Faced with an increasing financial burden due to its heavy reliance on imports, the government of China's late Qing era looked for ways to exploit the nation's vast iron ore deposits by developing its own military industry. And from this economic and political springboard came the motivation for the introduction of Western analytical chemistry into China.

Huaxue, meaning chemistry, and Kaozhi, literally meaning the study of quality - the Qing Dynasty's first textbook of qualitative chemical analysis – has long been considered to be based on the work of Fresenius from his Manual of Qualitative Chemical Analysis, the American edition of which was published in Philadelphia in 1875 and subsequently translated into Chinese in 1883 by John Fryer and Shou Xu.

However, this paper will seek to argue that the original edition of Kaozhi should not be considered as being from this textbook, but actually from the 7th edition of Fresenius' A System of Instruction in Qualitative Chemical Analysis, published in London in 1869. Along with this point, the paper will also address the importance of Huaxue Kaozhi in the development of analytical chemistry in the Late Qing period, along with a discussion of the role of Fryer and Xu in the translating and editing of this textbook and the influence that China's traditional natural philosophy exerted on the translation of new chemical terms into Chinese.

Huaxue Kaozhi; Fresenius; Fryer; Shou Xu; Qualitative Chemical Analysis

An approach to the comparative study on source materials in 17th and 18th century Europe and China

Miao Tian, The Institute for History of Natural Sciences (IHNS), CAS

Comparative study on source materials in the 17th and 18th century Europe and China can provide more comprehensive and deeper understanding of the transmission of early modern science and technology between Europe and China. Such study is important for the identification of the source and routine of the transmission, and some scholars hence evaluate the standard of the transmission. In this paper, based on case studies of the Chinese version of Euclid's Elements and its European source, we argue that such evaluation is not necessarily always refer to the Whig historiography. Based on detailed comparative analyzing of the source materials, especially with examination of the cultural and scientific context of terminologies, expressions and layout, in China and in the Europe, we may have a deeper understanding of the knowledge transmission across cultural boundaries.

comparative study; Whig historiography; Euclid; Elements

Research on the ancient documents of the astronomical clock tower of Song dynasty

Qiang Liu, Inst. for History of Science and Technology & Ancient Documents, Tsinghua University

The Astronomical Clock Tower is one of the greatest achievements on science and technology in ancient China, The book Xin Yi Xiang Fa Yao written by Su Song in Song Dynasty records many

detailed descriptions and exact figures on it, and is very valuable to the study of the instrument. This paper first narrates how the book circulated and collates the words of some different kinds of rare ancient editions gotten from several libraries. The second part surveys research done on the other ancient documents related to the Astronomical Clock Tower. We hope that it will contribute to the deeply study.

Astronomical clock tower; Song Dynasty; Xin Yi Xiang Fa Yao; Su Song

A review on the different versions of the book of A Treatise on Natural Philosophy

Xianbin Sun, The Institute for the History of Natural Sciences (IHNS) ,CAS

The book of A Treatise on Natural Philosophy written by Fang Yizhi mainly has five versions as below: Dajitang version, Tianruitang version, KangXi woodblock-reprinted version, Siku version and Ningjingtang version. There has little research of overall investigation and analysis on the various versions of the book by now, so its version filiation could not be worked out. And which now is shown in this paper through overall investigation and analysis on the various versions of the works all over the world. The features of the different versions are stated briefly as well, especially for the value of the versions of Dajitang and Tianruitang.

Fang Yizhi; A Treatise on Natural Philosophy; Dajitang; Tianruitang; versions

The Ambitions to Make Ammunitions: A Story about WU E and His The Making of Gunpowder with Illustrations

Zhou, Wei-qiang, National Palace Museum

The second half of the 19th century witnessed China's failure to defend itself against internal and outside enemies. The country's defenseless was partly caused by its insufficient military power. China began to purchase firearms from European and American powers. Not just firearms, China also purchased much ammunition. Imported ammunition took China's market by storm. To create an army not under foreign control, the Shanghai Armory was established in 1864 to create firearms and bombs of western design in order to supply the Huai Army. In the early days of the Guangxu reign(1875-1910), troops stationed in Anhui were equipped with percussion cap muzzleloaders. They needed a sizable supply of black powder as gun propellant and mercury fulminate ("white powder") as the firing agent. In 1876, in order to supply the Foreign Arms Corps of the Wan Army, Yulu, the Governor of Anhui, established the Gunpowder Office to manufacture their own gunpowder. The head of the office was WAN Xianshu at first, not for long, he was replaced by WU E. WU took the job of gunpowder manufacturing. He also registered the gunpowder manufacturing process in detail. He created 16 illustrated articles of gunpowder production and side articles on the making of test equipments such as a gunpowder test cannon. The articles are collected in the book The Making of Gunpowder with Illustrations. This book registered the techniques of the making of black powder and mercury fulminate of its days in detail. The steps of black powder production include the refinement of saltpeter, the refinement of sulfur, the production of charcoal, sifting of saltpeter and sulfur, grinding of saltpeter and sulfur, making of fine charcoal powder, mixing ingredients, grinding the mix, shaping by static weight compression, shaping by hydraulic compression, making grains, polishing grains, quality control and human resources. This book also included the making of a black powder test cannon and the preparation of mercury fulminate. There was no study on the Anhui Gunpowder Office. Very few have studied the history of gunpowder making during the early Guangxu

Reign. We studied WU E's *The Making of Gunpowder with Illustrations* to reveal Late Qing's local production of gunpowder and their efforts to establish an indigenous national defense industry.

WU E; The Making of Gunpowder with Illustrations; black powder; mercury fulminate; Anhui Gunpowder Office

071. Public Communication of Science and Technology and its history: between global and local

Discussant

Bruce Lewenstein, Cornell University

Science communication Public understanding of science Science and public

Traveling science centres and museums and their history in public communication of science

Jessica Norberto Rocha, USP

Martha Marandino, USP

One of the rewards of traveling science centres and museums is the possibility of fostering social inclusion through the offer of exhibitions and science communication programs in places where people usually do not have access to this type of activity. Institutions on wheels dedicated to the popularization of science have been on the road since the 19 century and are actors that are worth mentioning in the history of public communication of science and technology. Based on literature review in primary and secondary sources, in this session, we aim to cover general aspects of the history of science communication on wheels, in the world and in Brazil, specifically, their process of construction and influences, from the past to the present time.

From the 1850s on, some museums started touring and borrowing their exhibitions of art and natural history (i.e. Victoria and Albert Museum and the American Museum of Natural History) having in mind the mission of spreading the knowledge to outside the museums' walls. After the Second World War, the vehicles that carried the museum objects began to assume new roles and they were transformed into exposition venues. The first truck adapted into a museum was created in the US in 1948 in order to display artistic paintings. An important influence to these projects were UNESCO's actions, which inspired, for instance, the establishment of science museums in India and their traveling program. After that and until nowadays, many other initiatives were created in several countries around the globe, such as China, Australia, US and Mexico.

In Brazil, the creation of mobile science museums is relatively new. There was a private initiative in the 1960s for the popularization of natural history, in the state of Goiás. However, the idea was consolidated only in the 2000s, motivated by the launch of the PROMUSIT of the Science and Technology Museum (RS) and by a national public call for financial support promoted by the federal government. Today, there are approximately 30 science communication on wheels' projects in the country.

Finally, although traveling science centres and museums have undergone an expansion in the world, there are still many challenges: financial support, lacking public policies and few exchange and connection between institutions. Also, there is a need of developing more research and studies in the area in order to evaluate their scope and impact, as well as to tell their stories.

science museum; traveling museum; traveling exhibition

Attitudes to science – the ‘glocal’ legacy of the Withey study of 1957

John C. Besley, Michigan State University
Martin Bauer, London School of Economics

Researchers have conducted surveys around the globe of attitudes toward science since the 1980s (see Bauer & Falade, 2014). The earliest survey of this kind was conducted by Stephen Withey of the University of Michigan on behalf of NASW (National Association of Science Writers). This survey became globally influential when taken forward by the initial NSF survey series of the 1980 and 1990s (Jon Miller, 1983). Many of the Withey survey items are still used in attitude studies across the Americas, Africa, Europe, India, China, Taiwan, Korea and Japan. In this paper we will undertake three things. First, we will reconstruct some of the context of this study and chart the scholarly reception of the Withey results in subsequent citations, reviews and commentaries on science-society relations. This review will show us which aspects of the 1957 results were high-lighted and which got lost in this reception chain. Second, we will reanalyse the 1957 raw data, which we have reconstructed from ‘illegible files’, with modern multi-variate statistical techniques and report what Withey et al. could have observed in terms of knowledge, interested, attitude and media attention to science. Initial analyses suggest similar patterns of relationships to what we see in current US data, including relatively small relationships between science knowledge and attitudes and somewhat larger relationships between science interest and attitudes. Third, as some Withey items remain in the NSF series 60 years on, we will be able to compare and interpret the levels and predictors of these indicators of science in US American Culture into the 21st century and assess changes and stability of the science-society relation as reflected in these indicators. Additional initial analyses suggest substantial stability over time.

Science communication, public opinion, public understanding of science

Felix Ferreira and the Science for the People (1881): translations and science popularization in Brazil

Kaori Kodama, Fiocruz

This presentation aims to discuss Science popularization in the nineteenth century through the works of Felix Ferreira (1841-1898). Member of the Academy of Fine Arts, Professor of the Arts and Crafts Lyceum of Rio de Janeiro, he was also a journalist and art critic. As an editor, Ferreira was responsible for publishing, among other works, the weekly fascicles Science for the People (Sciencia para Todos), which circulated in Rio de Janeiro in 1881. The publication focused on the dissemination of knowledge of science to an audience of non-specialists and has a school character. Its varied content, highlighting topics such as hygiene, was largely composed of translations of French works, making it possible to understand the close connection between its editorial project with the actions of the popularizers of sciences of the period and the ideal of modernization. He denounced the lack of editions of science books addressed to the less fortunate, and defended the nationalization of textbooks in order to not only illustrate the popular, but also to increase the scientific community. The presentation intends to stress the particular kind of "cultural mediation" made by the popularizers to increase the presence of science and scientific thought in general culture, that is, forms of representation, perception and appropriation of contents related to the scientific subjects by non-specialist readers. At the same time, it focuses on some actions of some cultural mediators of science such as translators of the works of French, American and English popularizers. The translations of works of the European popularizers allows us to capture the circulation of knowledge,

and the communicational aspect of the science, reporting here to the considerations of the historian James Secord (2004). We aim to understand the works of translators and "publicists" who participated in the process of dissemination of texts for science education in the late nineteenth century as belonging to a type of mediators, referring here to the category intellectual-mediator (intellectual-médiateur) from reflections of François Sirinelli (1996). As belonging to the intelligentsia, the popularizers were spokesmen sometimes with his/her own ideals and political projects. Reflections on their activity may become relevant to rethink the varied manifestations of views on society, beyond the mere transmission of stable content of the natural sciences.

science popularization; press; nineteenth century; Brazil

Science popularization goes global: UNESCO's Division of Science & Its Popularization

Kristian H. Nielsen, Aarhus University

This paper provides a historical investigation of the Division of Science & Its Popularization, established in 1948 at UNESCO (United Nations' Educational, Scientific and Cultural Organization) in Paris, France. I will present the immediate context of the Division and its establishment; discuss some of the key actors and their views on science popularization; and finally provide an overview of the Division's activities across the globe.

The "S" was added at the last moment to UNESCO's name at the constituting conference in London in 1945. The first director of UNESCO, Julian Huxley, was a British evolutionary biologist with eugenicist and internationalist views. Huxley was instrumental in appointing Joseph Needham, one of the main architects behind the "S", as the first head of the Natural Sciences Section of UNESCO.

Huxley and Needham were both prominent public intellectuals advocating the view that science popularization was instrumental in facilitating proper social relations of science. At UNESCO, Needham proposed the "periphery principle" as a guiding principle for all UNESCO's efforts in science cooperation and science popularization. This meant, basically, that UNESCO should always aim at making scientific knowledge and resources available to countries at the periphery, i.e. less developed countries.

In late 1947, Huxley and Needham asked Danish science journalist Børge Michelsen to head UNESCO's newly established Division of Science & Its Popularization. Like Huxley and Needham, Michelsen was a left-wing convinced that science popularization ought to be pursued globally in order to heighten scientific literacy across the world, but also to raise awareness of the problems raised by the social impacts of science. Michelsen and his team initiated and coordinated science clubs, science films, science festivals, science radio shows and many more activities in many less developed countries, but also in the industrial countries.

UNESCO's activities in science popularization were global in scope, probably for the first time ever. The program certainly helped stimulate interest in science popularization across the world. However, partly due to the development of the Cold War, Huxley's, Needham's and Michelsen's views on the proper purpose of science popularization soon gave way to other understandings of popular science less focused on the social relations of science.

science popularization; less developed countries; UNESCO

072. Science, Technology, and Medicine in Local, Regional, Transnational, and Global Context

Medical Concerns under National and International Pressures: India during the Inter-War Years

Deepak Kumar, Jawaharlal Nehru University

Empires could not have been built or sustained for so long without suitable medical interventions. During the first half of the twentieth century, medical knowledge and practices underwent remarkable changes, so did the ways of governance in different colonies. These changes gathered pace during the inter-war years and this paper aims to explore the dynamics of why and how this change occurred and with what consequences in the context of British India. During this period, the national movement was on the upswing and demands were made for the Indianisation of the medical services and for more space to the indigenous medical practices. Despite certain advances in modern medicine, epidemics had become virtually endemic. Concerns were raised on national and international forums; quarantine alone was not enough. Even private philanthropy like the Rockefeller Foundation tried to intervene. This paper will try to capture the contours and quality of the debates and examine its reflections and consequences in terms of public health, medical institutions, and setting the agenda for the future.

medical, knowledge, British, India

At the Edge of Empire: Eugenic Influences in Forming the Nation of New Zealand

Hamish G. Spencer, University of Otago

Parts of the world that did not pass explicit eugenic sterilization laws are understudied by historians of the eugenics movement. New Zealand is one such place, where the influence of eugenic thought has been downplayed, to the point where some general histories completely ignore it. Nevertheless, in 1928 the New Zealand parliament came very close to passing such legislation. The government withdrew the bill's sterilization clause (and one other restricting marriage on eugenic grounds) at the last moment, even though it had the numbers to force passage. Campaigns to reinstate these two clauses continued for the following decade, but never achieved legislative success.

This history has allowed New Zealand to be classed as one of the places where eugenics had little influence. But, if the 1928 government had forced the issue and passed the sterilization clause, this classification would have been reversed and eugenics would have been viewed as highly influential. Thus, this dichotomous classification – based on the presence or absence of eugenic sterilization laws – is too simple, hindering a more informative and nuanced historiography. For example, sterilization on eugenic grounds certainly occurred, even after 1928, although its formal legality was unclear. The naïve view that eugenics had little influence in New Zealand hampers our understanding of the political context that allowed or even encouraged such operations.

Moreover, eugenic thought had already played a significant role in a number of New Zealand's early immigration laws. In New Zealand, some progressive politicians from around the turn of the 20th century thought that the young country had a great advantage in building a new society free from the stultifying constraints of British tradition. In their view, the new country was at the leading edge of the progressive agenda. Eugenic thinking was just part of a suite of new scientific and racial ideas that they could adapt to the New Zealand context in order to build an exemplary nation.

In short, a dichotomous classification of the influence of eugenics based on whether or not a country enacted eugenic sterilization legislation is too simple. In the case of New Zealand, which did not pass

such laws, it hides a more interesting history in which the eugenics movement enjoyed considerable influence and achieved other goals.

Eugenics; New Zealand; Sterilization

Reconfiguring Latin America's "Tropics"

Heather McCrea, Kansas State University

My work focuses on the idea of the “tropics” as a medical and environmental construct. During the late-nineteenth and early-twentieth centuries, yellow fever and malaria plagued the Panama Canal Zone, Havana, and Southeastern Mexico. Hence, aggressive public health campaigns to combat these deadly diseases categorized these lands and peoples as “tropical.” Such classifications, however, were not unilaterally imposed from the outside on static historical actors, but rather the “tropics” emerged as a fluid idea, allowing for local, regional, national, and trans-national adaptation to advance civilizing and modernization agendas.

Environment, Medicine, Tropics, Latin America, Caribbean

Roundtable Panelist in Symposium

Hugh Richard Slotten, University of Otago

As a Roundtable Panelist in the last 90-minute session with the Symposium, Hugh Slotten will be reviewing material covered in the earlier sessions and reflecting on the main themes in the Symposium.

Local, Regional, Transnational, Global

"Lines on a Map:" Border Blaster Broadcasting in the 1930s and the Geography of American National Identity

Michael A. Krysko, Kansas State University

Recent scholarship on interwar-era American radio has explored the connections between the rise of a national network-controlled commercial broadcasting system and the shaping of national identity among an American audience. Informed by Benedict Anderson’s notion of an “imagined community,” this scholarship explores the shared symbols and values that radio conveyed as it helped foster a common sense of identity among an otherwise anonymous audience. Other scholarship in sound studies seeks to demonstrate how the analyses into the act of listening, the very choice to listen, offers a window into understanding how media consumers make sense of the world around them. This paper seeks to build on that scholarship, but in a way that looks beyond national borders. In particular, it will focus on the quack doctor John Brinkley’s “border blaster” station established just south of the Mexican border in an intentional effort to evade US radio regulators while still broadcasting to a US-based audience throughout the 1930s. It will consider the relationship between national identity and listener engagement with radio broadcasts that stood outside the mainstream of the US national broadcasting system that emerged by the 1930s. How did these broadcasts that

crossed international borders engage manifestations of national identity among its listeners? Who listened to these broadcasts and why were they either drawn to or repelled by them? How did such broadcasts engage with processes of national identity formation when a distinctly American form of broadcasting illicitly crosses an international border to reach its targeted audience, garnering both popularity and condemnation within the United States? My answers to those questions, I suspect, will demonstrate the importance of keeping the values and ideals of technology's users at the forefront of the analysis. The very act of listening and reacting to these broadcasts will likely underscore how the values, ideas, and prejudices a listener brought to radio shaped how that listener understood, interpreted, and reacted to this international programming they encountered during the 1930s in often unexpected and unintended ways.

Radio, Broadcasting, Identity, Mexico, United States

Rethinking the Global and the Local in the History of Spaceflight

Michael J. Neufeld, Smithsonian Institution

Insofar as spaceflight has been considered at all in the history of globalization, it has primarily been through the lens of the “Earthrise era” (Benjamin Lazier) that dawned when the Apollo astronauts took the first deep-space color pictures of Earth between 1968 and 1972. These powerful images have had an impact on the common identity of humankind and on the environmental movement, although how much remains debatable and difficult to substantiate. The focus on these images, while legitimate, also reflects the popular and scholarly fixation on human spaceflight and outward exploration, whereas the great majority of human activity in space has been carried out by robotic spacecraft in Earth orbit.

Since the early 1960s, nations, corporations and international organizations have constructed a massive infrastructure in orbits ranging 200 km up to and beyond the 24-hour orbit at 35,600 km. Near-Earth space has effectively been annexed in order to serve life on this planet. This invisible infrastructure has many purposes, the most notable being global communications (both military and civil), surveillance (including weather, Earth science and military reconnaissance) and navigation (with military roots, but rapidly expanding civil applications). Protecting the stability of these systems is a partly *de jure* and partly *de facto* regime among the great powers. In effect, they have agreed not to deploy weapons in space or attack each other's systems.

The net result has been to fortify international stability through global transparency and through mutual interest in keeping satellite systems functional—although the potential destabilization of the space regime through military intervention remain a constant threat. These systems also have had notable effects on localities, whether it be through the divisive and integrative impacts of global news and television, or through the growing dependence on GPS and other navigation systems for everyday life in discrete localities of the planet. This paper will give an overview of the construction and impact of global satellite systems in order to suggest new paths for scholarship on globalization and spaceflight.

spaceflight, globalization, global, local, infrastructure

Trading Companies and Medical Knowledge Exchange: A Comparison between the Influences of East India Companies on Early Modern Japan and Nineteenth Century China

Shawn Foster, University of Minnesota

In his "Relocating Modern Science" Kapril Raj argues that the role of global trade and trading companies has been ignored in the rise and development of modern science. This insight seems to apply in studying medical knowledge circulation and construction between the East and the West. This paper compares two distinct cases. The first is the medical knowledge exchange between Dutch doctors with the Netherlands East India Company and the Japanese, a slow process that lasted more than two centuries. The second concerns the working experiences in China of European doctors with the British East India Company during the first thirty-five years of the nineteenth century. Both cases demonstrate that medicine is an important communication site in the process of cross-cultural knowledge exchange. However, the Japanese case happened at a time period when the interests of Western aggression were mostly focused on trade and when Western modern medicine was still in its infancy. The medical exchanges were bilateral and accompanied with an incremental advancement of medicine in the West. This gradual process resulted in an active acceptance of Western medicine on the Japanese side by the middle of the nineteenth century and their abandonment of previous official Kampō medicine at the same time. The short duration of the China case mostly eluded scholarly attention in the past. This study focuses on four aspects of these trading company doctors' work: the timing, the Chinese they contacted, the outcomes, and the differences between them and medical missionaries. The results illuminate the important role medical activities played when peoples from different cultures first met. Contrasting doctors of trading companies on medical knowledge circulation at different times and regions helps us to understand 1) the significance of medical knowledge exchange in cross cultural understanding and 2) the prominent shaping power of temporal contexts on how medical knowledge would be re-framed in 'foreign' cultures.

Trading Companies; Medical Knowledge Circulation; Early Modern Japan; 19th Century China; Borderlands' Communication

Roundtable Panel on Science, Technology, and Medicine in Local, Regional, Transnational, and Global Context

Susan E. Lederer, University of Wisconsin School of Medicine and Public Health

Michael A. Osborne, Oregon State University

John Stenhouse, University of Otago

local, regional, transnational, and global

The global and local "worlds" of smallpox control in Nepal

Susan Heydon, School of Pharmacy, University of Otago

Smallpox is the only human disease to have been eradicated and therefore this achievement remains of significance for international public health policy and practice. The aim of this paper is to use a conceptual device of distinct but overlapping "worlds", derived from an understanding of an underlying common set of assumptions in a "world view", to show the complex, interrelated yet

fractured and porous nature of medical encounters. The paper will draw on a case study of smallpox vaccination in the Himalayan country of Nepal to explore the multiple ways in which local, national, regional and global factors influenced smallpox control and later eradication.

Smallpox was an acute, extremely contagious, viral disease from which, almost without exception, people either died or acquired long-lasting immunity. It affected almost every part of the globe and was much feared. For more than two hundred years the “scientific” technology to control smallpox was inoculation of uninfected persons with the milder cowpox. Until 1967, when the World Health Assembly approved an intensified global smallpox eradication programme, control was undertaken at a local, national or regional level.

The paper focuses on two scenarios: the introduction of smallpox vaccination into Nepal in 1816 and the eradication of smallpox from Nepal in 1977 as part of the global Smallpox Eradication Programme administered by the World Health Organization. Each example demonstrates the importance of considering specific as well as broader narratives. In 1816 the government of Nepal, defeated militarily by the British, requested the introduction of vaccination from the recently imposed British resident. One hundred and fifty years later, Nepal introduced a novel vaccination strategy rather than relying on the favoured global method. Both therefore complicate the broader narratives of smallpox control, firstly in colonial South Asia and secondly the eradication programme.

By accommodating multiple perspectives in a single work, “worlds” provide a way to consider both the “big picture” and the “local”, to move beyond linear and oppositional analyses and to acknowledge their fundamental interconnectedness.

global; local; "worlds"; smallpox; Nepal

073. Science, Technology, and Medicine in the Andes and Beyond: Local Actors, International Health Specialists, and Global Ideas in the making of Scientific and Medical Communities

Virtues and pitfalls of the fight against tuberculosis in Cali: Dialogues between the State and Academia (1993-2015)

Jorge Enrique Figueroa Gómez, Universidad Icesi

Tuberculosis remains one of the most fatal and widespread infectious diseases at the global level. Transnational organisms such as the World Health Organization, have led several initiatives to fight this epidemic, which have been adopted by countries like Colombia as a public policy. Nevertheless, implementing such guidelines has been a process with a lot of tensions, setbacks, transitions, adaptations and resistances. Political, geographical, economic, social and technological particularities at the local level pose challenges to the standardization of treatment patterns at the national and global levels.

This paper aims to illustrate how the municipal public health office has carried out and implemented control strategies against tuberculosis immediately following the decentralization of Colombia's health system in 1993 and the completion of the Plan Estratégico Colombia Libre de Tuberculosis in 2015. It examines dissertations in medicine, epidemiology, public health, nursing and the social sciences, as well as local and national press and government reports, to show the adaptation of national and global guidelines at the level of local public policy. Furthermore, it highlights how the Cali's public health municipal area has questioned such models, through local initiatives supported by academic research, showing how the state, the production of scientific knowledge, and the implementation of public health programs interact with each other to produce a critical assessment of centralized and foreign public health intervention models.

Public Health; Tuberculosis; Public Policy; Locality; Global models

Bubonic Plague in Ecuador between Local and Global Processes

Kim Clark, University of Western Ontario

The bubonic plague epidemic that hit Ecuador in 1908 was the immediate catalyst for the establishment that year of the national Public Health Service. And Ecuadorians were right to take it so seriously: of all of the countries in the Americas that suffered bubonic plague outbreaks during the third world plague pandemic, only Peru had more plague cases than Ecuador in the first third of the twentieth century. A disease that came from abroad, was of compulsory notification under International Sanitary Conventions, and involved international collaborations in the 1920s to study its characteristics and to eradicate it from the port city of Guayaquil, plague is a likely topic for a study of global processes and actors. However, as an adaptive biological organism that had a distinctive disease ecology in each environment in which it developed, it also had local specificities that call out for analysis. Moreover, plague was primarily combated by Ecuadorians, with Ecuadorian resources and institutional arrangements. And both the disease itself and the campaigns to eradicate it took on distinct characteristics in different regional spaces across the Ecuadorian national territory. This paper is based on a rich body of internal documentation of the Ecuadorian Public Health Service, revealing the Service's everyday practices and the negotiated and contingent nature of its efforts to advance public health measures, create an institutional network that would permit it to act, and confront the deadly threat of plague.

Ecuador; public health; bubonic plague; eradication campaigns

Midwives, nurses and social workers: Female health professionals and the Welfare State, Chile, 1950-1973

María Soledad Zárate Campos, Department of History, University Alberto Hurtado

Within the frame of universal care that inspired the National Health Service (SNS), founded in 1952, a series of policies and programs were implemented that required a large contingent of health care professionals, including midwives, nurses and social workers. Among their duties, these professionals gave clinical care to the sick, promoted a pedagogy of health, coordinated administrative and social actions, provided medical supervision for vaccination programs and oversaw vital cycles such as pregnancy, childbirth and early childhood. These were some of the tasks that characterized the State Chilean welfare state until the 1973 Military Coup. The significant volume of health, educational and social intervention actions carried out by these professionals, together with the important training they received in the SNS sponsored by international organizations such as the World Health Organization, was a constitutive aspect of the professional and gender identity of this group of women. Through an examination of written sources (monographs, statistics, official SNS reports), and a group of interviews to professionals who worked in the SNS since the 1960s, this paper develops two central arguments regarding their historical trajectory. First, it provides background that documents the work these professionals performed, distinguishing those prescriptive tasks - mainly described by documents produced by the medical community - from the tasks they actually performed, characterized in the documents they produced and the gathered interviews. Secondly, this paper intends to describe how the implementation of the Chilean health policy promoted by the SNS - thanks to the assistance protagonism of these professionals - was legitimized in the community and expanded throughout the national territory with a speed and effectiveness, scarcely recognized by the medical community of that time and by the current historiography.

The Science of Nutrition: Local Health Workers, National Officials, and International Actors Debate Appropriate Nutrition in Post-Revolutionary Bolivia

Nicole Pacino, University of Alabama in Huntsville

After Bolivia's Movimiento Nacionalista Revolucionario (MNR) took power in the 1952 National Revolution, it tried to address Bolivia's most pressing political, economic, and social problems. Beyond universal suffrage, nationalization of the mining industry, and agrarian reform, which are the most well studied of the MNR's reforms, the government looked to expand public health programs to improve Bolivians' overall standard of living. Chronic malnutrition was one of the issues targeted by public health reform.

In this paper I address conversations between local, national, and international actors about how best to address Bolivians' inadequate nutrition in the 1950s and 1960s. Actors at each level had different definitions of nutrition, understandings of the problem, and approaches to fixing it. On the local level, officials drew attention to deficiencies in people's diets. Conversely, national health workers and doctors blamed these individuals for their inadequate diets, citing women's and indigenous communities' ignorance of proper nutrition. International actors, sometimes oblivious to debates happening at the national level, often blamed national doctors' and government officials' lack of training and experience for institutional disorganization. In examining these overlapping discussions, where blame for malnutrition was constantly shifted to different targets, I argue that actors at each level presented malnutrition as an imminently solvable problem. However, these varied approaches' disunity meant that the problem was never quite solved.

Nutrition, Bolivian Revolution, Gender

Sex and Cervical Cancer Etiology in Early 20th Century Peru

Raul Necochea, University of North Carolina

The transformation of cervical cancer into an infectious disease, by virtue of its link to strains of the human papilloma virus (HPV), was complete by the early 21st century. Nonetheless, physicians and scientists had been connecting it to female sexual behaviors as early as the 19th century. Then, as now, experts in countries such as Peru struggled to make sense of the uncertainty of symptoms and signs detectable with new technologies, such as the colposcope and Pap smear, as well as with the pressing need for population growth, threatened by an illness that struck women in their prime reproductive years. Using medical periodicals and theses from the first half of the 20th century, this paper analyzes the politically charged discourses about "proper femininity" that physicians championed prior to the advent of effective chemotherapies. Peruvian physicians hoped, along with colleagues elsewhere, that cancer awareness would motivate women enough to consult physicians more frequently and, more specifically for the Peruvian context, would also lead women to embrace a duty to assert the importance of women's reproductive health.

cancer; reproduction; gender roles

074. De-centered science, for real? Transits of mining chemistry, medicine and natural history in Europe and Latin America

Transit of knowledge on minerals in the 18th century: England as case study

Andréa Bortolotto, CESIMA/PUC-SP

Eighteenth-century attempts to improve the efficiency of metallurgical processes and the identification and classification of minerals resulted in the publication of a considerable number of works on mineralogy and metallurgy all across Europe, Sweden and the German lands in particular. Many such books were translated into other languages, in some cases soon after the appearance of the original. This is, for instance, the case of J.A. Cramer's *Elementa Artis Docimasticae*; originally published in Latin in 1734, a first English translation appeared two years later, followed by a second edition dated to 1764.

Like Cramer's, also other books were translated into English by that time, such as *Pyritologia or a History of the Pyrites* by J. F. Henckel, *An Essay Towards a System of Minerology* by A. F. Constedt, *Metallurgic Chemistry* by C. E. Gellert and *An Essay on the usefulness of Chemistry* by T. Bergman. Performed at a time characterized by much interest in large-scale production of high-quality metals, these translations contributed to the transit of knowledge originated in areas with a highly respected tradition in metallurgical work. While these works seem quite similar overall, a closer analysis reveals considerable differences, which had major influence on the establishment of fields of knowledge like mineralogy and metallurgy.

In this presentation I will discuss the specific characteristics of these works, as well as their global meaning for the study and development of 18th-century metallurgy and mineralogy. Within this context, I will pay particular attention to the presence of information originated abroad in books published in England.

metallurgy, mineralogy, history of chemistry

Coffee and its Relation to Health and Nutrition in Nineteenth Century Brazil

Cristiana Loureiro de Mendonça Couto, Pontifícia Universidade Católica de São Paulo

Ana Maria Alfonso-Goldfarb, Pontifícia Universidade Católica de São Paulo

By mid-19th century, Brazil had become the first world coffee producer. This fact had a major role in the early development of industry in the country. Given such high status and increasing consumption by the locals, coffee also called the attention of Brazilian doctors at the time. In this presentation, I will discuss the ideas of nutrition and health related to the properties of coffee in the theses defended at the School of Medicine of Rio de Janeiro between 1850 and 1880, as well as its presence in contemporary cookbooks published in Brazil and abroad.

Brazil; coffee; nutrition; medical theses; cookbooks

Surgical skills on the move: the case of thoracic surgeon Clarence Crafoord and his trips to South America (1948-65)

Daniel Normark, Unit for medical history and heritage, Karolinska Institutet & STS Centre, Uppsala University

A common theme in science & technology studies (STS) has for the last 30 years been questioning the universality of science by looking at the situated dependencies and local preconditions that enable new knowledge claims and “discoveries”. However, as “universality” is debunked the distribution and expansion of knowledge and skills becomes a phenomenon that has to be explained rather than taken for granted. This paper will address the distribution (or translation) of skill by looking in particular on one practice and one of its prominent pioneers – the thoracic surgeon Clarence Crafoord (1899-1984).

Despite the implementation of numerous technologies and pharmaceuticals, surgery is still regarded as a predominantly skill-based medical practice. The specialization and expansion of surgery has been tremendous during the 20th century. But how, if we assume that knowledge and skills are inherently local, can this expansion and distribution take place. Thoracic surgery, like many other medical practices, is centered on advancements, both technically and experimentally, in the USA. However, some exceptions exist such as Clarence Crafoord, that became one of the pioneers from his hospital, Sabbatsberg, in Stockholm.

Looking closer at the practices around Sabbatsberg and Clarence Crafoord two features become particularly interesting. 1) a frequent amount of surgeons visiting Sabbatsberg, during Crafoords active career and 2) regular trips abroad to teach and demonstrate techniques, made by Crafoord and his team. After one trip to Poland, under the coordination of UNNRA, Crafoord conducted four trips to South America between 1950-1965. And these trips will be the main subject for this paper. The trips show: 1) collaboration created by two peripheral nodes (without its academic centre) 2) the distribution of skills required an “assemblage” of staff, technologies and practices; 3) new technologies were quickly distributed within the network of relations, and 4) the preconditions for the trips shifted considerably due to the economic and political changes that took place – both in Sweden and in especially Argentina. By reconstructing the trips in Sweden and South America, I hope to show how an international actor is composed while providing a tale about the pre-story to the South American advancements in thoracic surgery.

mobility; skills; thoracic surgery; educational trips

Connecting and collecting: Scientific mobility and shifting geographies in early nineteenth-century comparative anatomy

Eva Åhrén, Karolinska Institutet, Unit for Medical History and Heritage

Early nineteenth-century anatomists in Europe collected and prepared vast amounts of human and animal material for comparative research, and educational purposes. They studied, described, depicted, and displayed specimens, which they assembled with the help of national and transnational networks of scientific exchange. Anatomy museums and their spaces for dissection and preparation were prime locations for producing and communicating anatomical knowledge. Specimens were not, however, stationary: they traveled locally, regionally, and globally between collection sites, lecture halls, artist’s studios, and laboratories. New knowledge, developed through the study of specimens, also circulated widely, as did methods and technologies of observation and preparation, which scholars described in their publications.

This paper will take the anatomy museum at Karolinska Institutet in Sweden as a point of departure for a discussion of mobility and place in relation to anatomical practices. The museum was created by

Anders Retzius (1796-1860), an innovative scientist and educator with an wide network of colleagues. His closest collaborators were comparative anatomists the Baltic region, who engaged extensively in scientific exchange by traveling, speaking, corresponding, trading specimens, and publishing. They shifted the scientific center of gravity away from Paris in the early to mid-nineteenth century in the new political geography after the Napoleonic Wars.

Retzius's talks, articles, illustrations, letters, and travel notes will be used to examine how circulated specimens, drawings and printed visualizations of tissues and body parts were used to assert scientific authority; how specimens functioned as mobile (and sometimes contested) bearers of anatomical knowledge; and how traveling connected rising centers of medical learning on the European periphery. It will also investigate intersecting networks of exchange and knowledge production, arguing that comparative anatomy was a dispersed practice, dependent on infrastructures facilitating connection and circulation locally and globally between diverse sites and actors.

Sites of anatomy; circulation of knowledge, museum collections; specimens; nineteenth-century

Global goods and local – Latin-American coffee and Scandinavian import substitutes in the first half of the nineteenth century

Hanna Hodacs, University of Dalarna, Sweden
Mathias Persson, Uppsala University

The purpose of the paper is to explore the relation between local tastes and global goods in nineteenth century Scandinavia focusing on coffee. While the eighteenth century saw a rise in coffee consumption in Scandinavia it was only in the nineteenth century coffee drinking expanded sharply. Today the Scandinavian countries top the world league of coffee consumers relatively speaking. The take-off of coffee consumption in the early nineteenth century corresponded in time with the expansion of coffee production in Latin America, and particularly Brazil. The coffee bean had arrived to the Atlantic world from the Middle East and North Africa less than a century earlier, as part of a plant transfer, it was only however with the Latin American production that Atlantic coffee became a truly successful global goods. Economic developments in the Nordic countries do also form an important backdrop to the take-off of coffee consumption among Scandinavians. The early nineteenth century saw a more sustain integration of a market-based economy across rural areas, replacing micro exchange economies on a large scale. The uptake of consumption of Latin American coffee in Nordic countries does in this sense reflect both local and global developments. The arrival of the new Brazilian crop did however also promote some very local responses. Simultaneously with a sharp rise in coffee consumption in the Nordic countries a range of books and pamphlets were published promoting import substitutions. Herbs such as Chicory but also range of local nuts and seeds were promoted as alternatives to coffee beans.

In the light of this development the paper will analyse how the taste of coffee was negotiated, analysing the promotion of Brazilian coffee and local substitutes in Sweden from the 1820s until the 1870s. The chapter will explore the relations between tactile references (taste, smell, look, and feel), references to the exotic and the domestic, and arguments to do with public health, political economy and chemistry, defining the identity of both the global goods and its local substitutes. Particular focus will be directed towards how the identification of caffeine, discovered 1819/1821 by German and French chemists, became incorporated into the discourse around coffee and coffee substitutes.

Coffee, import-substitution, taste, Sweden, Brazil

Movements of men and metals: The regional and foreign study tours of the Swedish Bureau of Mines 1700–1750

Jacob Orrje, Stockholm University

In the 18th century, the Bureau of Mines was in charge of the mining and smelting of the Swedish realm. However, it was also concerned with the education of new officials, through an educational system of “auscultation”. As a part of their education, young auscultators were generally encouraged to travel both regionally around the Swedish core provinces and to the mining districts of other Northern European states. Moreover, they were encouraged to submit travelogues to the Bureau’s archive. This archive became a shared experiential base for future auscultators and travellers. Through these tours, the Bureau of Mines became part of several circulations of men, texts and metals.

This paper studies the officials’ study tours from a systemic perspective. It examines how repeated regional and foreign tours transformed auscultators and forged a knowledge community of state officials. Moreover, it also analyses how these voyages defined the indigenous regions policed by the Bureau and connected them to other spaces in Europe. Finally, it proposes that domestic and foreign tours should not be studied as essentially different. Instead, all tours were part of the Bureau’s efforts of controlling the movement of men and metals.

study tours; education; mining; 18th century; circulation

Physical Therapy as a De-Centered Science. Ernst Georg Aberg: the Argentinean Journey of a Swedish Physician

Jaime Elias Bortz, ISO-CYTE - UBA - UNLaM

Ernst Georg Aberg was born in Stockholm, Sweden, on 18 August 1823. He studied medicine at the University of Uppsala, where he earned his doctorate in 1850. Having perfected his studies at the Karolinska Institute, he earned the title of Chirurgiae Magister.

Falling sick of tuberculosis, he immigrated to Argentina in search of a better climate to cure his illness. In 1856 he obtained the revalidation of his title at the School of Medicine of the University of Buenos Aires. In 1871 played an active role during the outbreak of yellow fever. The following year was appointed member of the Waters, Sewers and Paving Commission, an organization that was responsible for planning sanitation work in the city of Buenos Aires within the framework of hygienist thought. In 1874 was appointed member of the Academy of Medicine. In 1877 he resigned from the Commission and the Academy of Medicine to return to Sweden, where remained until 1878.

In 1884 he returned to Buenos Aires and founded the Therapeutic Institute of Mechanical Gymnastics or Kinesitherapeutic Institute. This institution was in line with the principles of mechanical gymnastics described by the Swedish author Gustav Zander and innovated in South America through the application of gymnastics machines to therapeutic purposes. In 1884 he published the text which is considered the first American publication concerning the therapeutic virtues of physical exercises, Mechanotherapy of Zander. His work turned Argentina into one of the pioneering countries in the training of physiotherapists in the region. In addition to the equipment it applied the concepts of gymnastics of the Swedish author Ling, based on the principle that the same forces that cause deformation can correct it.

In 1890 the Academy of Medicine conferred him the title of Honorary Academician. He traveled to Sweden again in 1890, staying there 9 years. In 1899 returned to Buenos Aires and died in this city on May 30, 1906, being buried in Recoleta Cemetery.

The aim of this work is to understand the role of Ernst Georg Aberg in the process of implementation - among Argentinean medical elite at the end of nineteenth century - of the Swedish science of

movement, gymnastics and physical treatment as an innovative therapeutic option and a model of scientific knowledge transit between two de-centered countries, Sweden and Argentina.

Swedish physicians; scientific immigration; Argentina; Physical therapy

Making Metallurgy Modern: A Cultural History of Scientific Change in Preindustrial Sweden

Linn Holmberg, Stockholm University

The paper examines the intellectual, cultural, and practical process of making metallurgy a 'modern' science by exploring the history and evolution of a forty-year long encyclopedic enterprise in eighteenth-century Sweden. The enterprise was undertaken c. 1740–1789 by two mining officials of the Swedish Bureau of Mines (Bergskollegium): the acclaimed metallurgist Sven Rinman (1720–1792) and the practically unknown mining official Anders Robert Bellander (1726–1772). The preserved material – consisting of a ten-volume manuscript draft (compiled by Bellander c. 1740–1772), later annotations and revisions (added by Rinman c. 1784–1787), and the finished "Bergwerks lexicon" (published 1788–1789) – has never been subjected to focused research. Together this set of sources provides an intriguing insight into the transnational process of defining and redefining the boundaries of metallurgy, chemistry, mining technology during half a century. The paper delineates the history and general evolution of the lexicon, discussed in the light of the cultural and social framework of the Bureau of the Mines, and the lives, careers, and practical experiences of the two compilers.

metallurgy; chemistry; encyclopedism; 18th century; Swedish Bureau of Mines

Development of genome projects in Brazil: Xyllela, the success case and human cancer, the failure case

Marimelia Porcionatto, Universidade Federal de Sao Paulo - UNIFESP

When, in the late 1980's, an international consortium of research laboratories led by the US, decided to undertake the enormous effort to sequence the entire human genome, Brazilian scientists decided they wanted to be part of that too. Although with much less money than the Human Genome Project (HGP) initiative, the Sao Paulo Research Foundation (FAPESP) funded more than 200 scientists based in Sao Paulo institutions that took the challenge to equip and develop the expertise to sequence the genome of the bacterium *Xyllela fastidiosa*, a microorganism that attacks orange trees. This first attempt to form and run a network of molecular biology labs was so successful that the US asked for help when they came to sequence the genome of a related *Xyllela* strain that attacks grapes in California. Still feeling like someone not invited to the party because Brazilian labs were not part of the international HGP consortium, the same agency decided to fund yet another round of whole genome sequence. This time, aiming to add information to the ongoing HGP developed by the international consortium composed of labs in the USA, Japan, and several European countries, scientists decided to sequence human cancers. To those familiar with the onset and development of tumors and cancers, this immediately raised a red flag. Tumors and cancers are a whole different deal when you compare with healthy cells, such as what the HGP used. Cancer cells are normal cells with aberrant genomes. Ignoring the alerts by many scientists in the Brazilian community that the use of cancer cells to gather information on human genome would be a waste of money and valuable resources, the labs that proposed this ambitious project were funded. In the end, it resulted in nothing, the opposite of what happened in the case of *Xyllela*. This paper aims to present and discuss the details of these two cases of

significant money investment in similar projects with very different outcomes and raise the discussion about following trends in science set by those countries considered more developed.

genome; human genome project; sequencing

Naturalising in Brazil: Brazilians connections in Swedish 19th c. medicine, anatomy and natural history

Olof Ljungstrom, Karolinska Institutet

This paper intends to review Sweden's 19th century Brazilian natural history contacts in order to open the narrative to a set of questions regarding the conditions of doing scientific work in the 19th century. The suggestion is to treat the situation as an example of Kapil Raj's use of the concept of "science en plein air", open-air science (itself originally culled from Michel Callon). How did natural history come bundled together with the official (administrative and/or military) or commercial activities it depended on to gain access to places, things and people? The pivotal figure for this is Anders Fredrik Regnell (1807-1883).

In 1840 the physician, botanist and natural historian Regnell stepped off the boat in Rio de Janeiro, never to return. In 1884 he died in the town of Caldas in the province of Minas Gerais, by then a wealthy man, and naturalized Brazilian. In the four intervening decades Regnell had been a prolific collector of botanical, animal, and human (anthropological) specimens. He had played host to Swedish scientific travellers to Brazil, as well as donated lavishly to major Swedish scientific institutions of everything from specimen collections to entire buildings.

Regnell became the local point-man for the Swedish acquisition of scientific collections intended for "analytical display" (in the late John Pickstone's words). He wasn't the first, that honour would belong to the German ornithologist Georg Wilhelm Freyreiss who in the 1810's had been the Brazilian travel-companion of the natural historian Prince Maximilian zu Wied-Neuwied, but simultaneously employed as botanical collector by the Swedish Consul Billberg in Rio de Janeiro. Aside from Regnell Swedish scientists also maintained direct contacts with Brazilian colleagues, as evidenced by the correspondence and exchange between the professor of anatomy Anders Retzius in Stockholm and the Bahia anatomist Jonathan Abboth. Enabling contact and exchange was also the recurrent event of Swedish navy school-ship expeditions to the Brazil in the mid-19th century.

Natural history; collecting; anatomy; race science

Actors, sites and practices: Mexican materia medica, XVIII-XIX centuries

Patricia Elena Aceves Pastrana, Universidad Autonoma Metropolitana Xochimilco
Liliana schifter, Universidad Autonoma Metropolitana Xochimilco

Knowledge, as other elements of human culture bears the imprint of the sites, places and territories where it is practiced; in other words, of its location. From this perspective, this paper analyzes mexican materia medica of the late 18TH-century and the first half of the 19TH century.

The main social actors that participated in the study, classification and application of natural sources of vegetable, animal and mineral specimens are discussed. The aim is to highlight how the materials and the knowledge of chemistry, medicine and natural history transited during a period in which these fields of study suffered large transformations and in which the emergence of the new Mexican nation took place.

Mexican materia medica; pharmacopeias; chemistry

HOMO. Nosce te ipsum: classification of humans and Karl von Martius program for writing the history of Brazil

Raphael Uchôa, PUC-SP

In 1817 the king of Bavaria sent the naturalists Karl von Martius (1794 – 1868) and Johann von Spix (1781 – 1826) to Brazil for a scientific expedition. The work resulting from their three-year travel had an enormous impact on early 19th-century natural history and medicine, as well as in the writing process of the “Brazilian national identity.” This paper will consider Martius’ early nineteenth-century classification of “Brazilians” as well as his program for writing the history of Brazil. I will address two fundamental aspects: 1) how Martius mobilized concepts such as monogenesis, human races, and civilization into his historiographical program and 2) the way he placed “human objects of natural history” and human costumes into eighteenth-century schemes for classifications of natural history.

Natural history of man; classification; human races; Karl von Martius; historiography

Blurring boundaries across nations between positive and negative eugenics

Rodrigo Andrade da Cruz, IFSP, PUC-SP

Luciana Costa Lima-Thomaz, CESIMA, PUC-SP

The specialized literature on the history of eugenics at the turn of the 19th century established two well-defined patterns, to wit, the so-called Mendelian and Lamarckian varieties of eugenics. The former allegedly developed on the grounds provided by the Darwinian natural selection, biometrics, and early genetics, and the second on the assumption of the inheritance of acquired traits and the law of use and disuse formulated by Jean-Baptiste Lamarck (1744-1829). According to the standard view, Mendelian eugenics was based on the assumption of the invariability of the hereditary stock, whereby the unfit ought to be subjected to so-called “negative” eugenics procedures, compulsory sterilization in particular, which was initially promoted in the United States. Contrariwise, Lamarckian eugenics posited the intrinsic variability of the hereditary stock. As a consequence, improvement of the social and physical environmental conditions would lead to the improvement of the human hereditary stock over the course of time. This was held to represent a “positive” approach to eugenics, which developed particularly in France. The aim of the present study is to subject this automatic identification American/Mendelian/negative and French/Lamarckian/positive eugenics to critical analysis based on the study of healthcare policy in different countries, including Brazil.

Eugenics; Positive eugenics; Negative eugenics

Institutionalization of medicine in the early 19th century: the case of homeopathy in Brazil and Sweden

Silvia Waisse, CESIMA, PUC-SP

Motzi Eklöf, Karolinska Institutet

Homeopathy was formulated in the early 19th century as one among the many responses to the ongoing crisis undergone by medicine, especially as concerned practice and therapeutic outcomes.

Homeopathy spread across the world soon after its inception in several waves that can be categorized per decade (1810s, 1820s, and so forth) having variable reception in the various countries as a function of the local status and degree of institutionalization of medicine and development of healthcare delivery.

In this presentation we will compare the cases of Brazil and Sweden, as representatives of peripheries (peripheral and central, respectively). Homeopathy arrived in Brazil at the end of the 1830s via French doctors, at a time when conventional medicine itself was striving for institutionalization, being that the first medical schools entitled to deliver doctoral degrees were founded in 1832. Naturally, the number of practicing doctors was then excessively small, and their distribution was highly limited to the two main colonial centers, Salvador (Bahia) and Rio de Janeiro, then the capital of the Brazilian Empire. The resulting panorama was one of competition between two medical rationalities and the problem posed by healthcare delivery in a young country of continental dimension.

The first notices on homeopathy arrived in Sweden straight from Germany, its birth, in the 1820s, but only began to be practiced the following decades. At that time, medicine was well established in the university setting, however, the number of practicing doctors was very small, having been trained mostly within the context of Naturphilosophie/Romantic medicine. In addition, another contending approach to healthcare, namely, P.H. Ling's gymnastics had already taken sound roots in the country. The intended comparison will be based on the following criteria: modalities and status of healthcare delivery, the role of the state, and the relevance of outcomes vis-à-vis theoretical consistency.

Homeopathy; Brazil; Sweden; 19th century

Manuscript Japanese world map (1886) from the Banco Santos Collection: De-centred Ways of Knowledge Transmission

Vera Dorofeeva - Lichtmann, CNRS

My paper is concerned with the rediscovery of a large manuscript Japanese world map dated by 1886, which accidentally occurred in 2008 at the Institute of Brazilian Studies (IEB) of the University of São Paulo (USP). The map has not yet been widely presented to the scholarly community and it is a great pleasure to do this at the 25th ICHST, which takes place on the Brazilian land.

The map originates from the Banco Santos collection of maps (São Paulo) and owes its birth to the vivid interest in maps of its chairman, Edemar Cid Ferreira. In a year after its bankruptcy in 2005 the maps were deposited at the USP and are currently in the custody of the IEB, thanks to the marvellous job by its staff, having become part of the Biblioteca Digital de Cartografia Histórica (www.cartografiahistorica.usp.br). The map in question is digitalised, but not yet uploaded.

The map was first erroneously listed as an "undated Chinese map of Americas". In effect, the map is precisely dated and signed by a Japanese author (otherwise unknown). It consists of two separate hemispheres drawn within a span of several months. The map looks as an ordinary late modern Japanese map following the Western cartographical framework, which only interest may be its manuscript drawing. At a closer look, the map is distinguished by a striking contrast between an outdated approximation of the "Old World" and much more precise representation of the "Americas". The two worlds are also demarcated optically through the difference in colours – the "Old World" looks faded and blurred, the "New World" bright and sharp.

The unusual contrast between the two hemispheres allows one to advance a hypothesis that the map might have been drawn in Latin America by a Japanese immigrant or descendant, having thus detoured the European and the East Asian 'centres' of cartographical traditions. This would explain a good knowledge of the Latin American geography and political events that shaped its division into countries about 1886, and also of Africa, which has always been a strong point of the Luso-Iberian cartography, while maintaining some archaic concepts and place-names in East Asia. This bold hypothesis has, however, to be checked in a meticulous way. If confirmed, it would make the map in

question an absolutely unique among typologically similar specimen, and, at the same time, provide rich evidence of complex de-centred ways of transmission and fusion of cartographical knowledge.

World Maps, History of Cartography, Late Modern Japan, Japanese in Latin America

075. Recording and communicating practical and theoretical branches of knowledge in the history of science, medicine and technology

Experientia literata: a method for the development of practical knowledge

Bernardo Jefferson de Oliveira, Universidade Federal de Minas Gerais

Although he criticized craftsmen's lack of record and systematization, Francis Bacon acknowledged a fundamental aspect of knowledge in craftsmanship. In an attempt to compensate what he considered important shortcomings, he put forward a method of discovery, which he named *experientia literata*.

This learned experience is directed towards the systematization of proceedings technicians adopted by chance. This systematization comprises records and simple communication. While the inductive reasoning developed by Bacon in his *Novum Organum* would lead, albeit after a long process, to essential definitions, the more pragmatic learned experience would serve as a guide to future operations. Even though it is only a minor part of Bacon's work, the *experientia literata* entails, in addition to the generalization of technical knowledge, a new steering of its progress. It aspires to give direction and order to the wandering experience, by offering probing techniques that, in a practical manner, would lead to the invention of new crafts and products.

One can summarize the learned experience in eight operations: *Variatio*: variation of materials, causes and quantities; *Productio*: production of experiments, i.e., their repetition and extension; *Translatio*: transference of a proceeding from one craft to another; *Inversio*: performing a regular process backwards; *Compulsio*: extending the experiments as far as possible, until its effects are no longer visible; *Aplicatio*: applying something already known in another useful experiment; *Copulatio*: junction of various experiments at once; *Sortes*: trying out one's luck by performing experiments that may seem absurd and, therefore, were never tried before.

As the examples provided by Bacon – farming, distillation, casting, therapy – demonstrate, such operations are intended to improve practical knowledge and productive activities. They certainly also concern the knowledge of nature, but not as would be expected from a natural philosopher. They are general rules for the invention and improvement of techniques, and not of a spiritual, academic or erudite knowledge. For Bacon, control of nature is what reveals true knowledge of the latter. However, in order to obtain it, shared effort and its register are indicated as fundamental.

Francis Bacon; experientia literata; method of discovery; technical knowledge

From technical investigations to scientific studies: count Rumford experimental endeavor and its possible unfolding about air heat propagation

Eliade Amanda Alves, PUC-SP

Fumikazu Saito, PUC-SP

This essay is part of doctorate research that has been developed in the History of Science Post-graduate studies program CESIMA/PUC-SP. It aims to present some aspects of the relationship between science and technique, based on Benjamin Thompson's, later named count Rumford (1753-

1814) works and studies about air heat propagation. Thompson is well known by historians of science not only for his theoretical and experimental works, but also for his technical abilities. In fact, in addition to having endeavored to demonstrate experimentally the immateriality of heat, he created and improved several devices and inventions, such as fireplaces, stove, chimneys, coffee machines, lamps, and others. At first sight, such inventions and improvements could be considered apart from other theoretical studies. However, an analysis more focused on Rumford's experimental work has brought clues that his inventions were narrowly related to his speculations about air heat propagation, since it was probably from his technical investigations that he eventually classified the air as a bad conductor, ruling it out as a possible medium of heat propagation. This way, based on two Rumford's studies, "Of the Management of Fire and the Economy of Fuel" and "An Enquiry concerning the Nature of Heat, and the mode of its communication", published respectively in 1797 and 1804, we intend to relate the technical considerations about air heat propagation investigations to his theoretical conclusions about the nature of heat.

count Rumford; heat; heat propagation; technical investigations

Monsters and wonders: The emblematic view of animals in Conrad Gesner's *Historia animalium*

Fabiana Dias Klautau, PUC-SP

The objective of this paper is to demonstrate the perspective of sixteenth-century nature scholars about a natural history that reflected a world where animals composed a complex language of metaphors, symbols, and emblems. The meaning of knowledge about animals was deeper than describe its internal and external parts, but also and especially its virtues, legends and stories, the coats of arms where its image could be seen, etc. Our study search on Conrad Gesner's (1516-1565) *Historia animalium* (1551-1558) and the connections contained in his description of animals. Our intention is to show that the content of the work elaborated by Gesner presents particular characteristics and its descriptions were especially loaded with additional information, such as legends, fables, use in medicine, cooking, art, etc. His purpose was to embrace all aspects of knowledge about animals, and therefore it was possible to find in his work all the animals, included the ones which that had a uncertain existence, and those referred by ancient and modern authorities, even monstrous and wonderful animals like the mantis, the satyr or the lamia. All of this linked information was part of a collection of knowledge, called by some scholars of this period of emblematic world view which characterized the history of animals in the sixteenth century. Symbolism was an important part in the interpretation of nature during the Renaissance and to demonstrate some interrelated information in Gesner's work we selected the *Emblematum Libellus* (1531) by Andrea Alciati (1492-1550), a book of emblems about moral, education, policy, and others subjects, through themes such as love, flora and fauna, mythology, astrology. These emblems were also widely disseminated in the Gesner's descriptions.

Conrad Gesner, beasts, emblematic view

Neuroscience, Technique and Utopia

Francisco Rômulo Monte Ferreira, Instituto de Psicologia - USP
Francisco Assis de Queiroz, Departamento de História - USP

Presentation: Neuroscience reaches theoretical unity in the set of theses that integrate the neuronal theory and that has as main proponent the Spanish Santiago Ramón y Cajal (1852-1934). The works of Ramón y Cajal on the neuronal theory occur mainly in the period between the end of the nineteenth century and the first quarter of the twentieth century. There are countless works in agreement with the birth of the neuroscience from the works presented by Ramón y Cajal (Shepherd, 1991; Santander, 2002; García-Marín et al, 2007, 2009; Finger, 1994, 2000; DeFelipe, 2007, 2010; Barlow, 1995; Ramón y Cajal, 1952).

The disciplinary formation of Neuroscience occurs in the twentieth century. Formation of specific research areas and nuclei along with increasingly specialized publications. Neuroscience has become one of the so-called emerging technologies in the mid-second half of the twentieth century. An important theme that goes beyond this story refers to the role of microscopy and coloring techniques in the development of Neuroscience and its formation as a scientific discipline and the way in which Neuroscience is embedded in utopian conceptions of Science and Technology in Decades.

Aims: To examine the relationship between the formation of the disciplinary program of Neuroscience, the development of microscopy techniques and the idea of utopia. To do this, we will first examine the question of technique and technologies in a broader and, indeed, abstract. In a second moment we direct the discussion to the specific case of Neuroscience in the last years and to what extent we can speak in perspectives somehow utopian in the neuroscientific agenda.

Partial Conclusion: For conclusive purposes we will turn the analysis towards two preliminary hypotheses: (1) The development of Neuroscience does not follow the expectations around it; (2) The prominent role in the techniques and technologies applied to studies of the nervous system may not present any advances related to the prognosis for the future of the area.

History of Neuroscience, History of Technique, Utopia

Visio, perspectiva and representation of space in the sixteenth-century linear perspective treatises

Fumikazu Saito, Pontifícia Universidade Católica de São Paulo

Current studies in history of science have shown evidences for the impossibility of drawing a clear distinction between optical studies and linear perspective in the sixteenth and seventeenth centuries. Although linear perspective dealt then with the geometrical representation of space in a surface, it was closely related to issues concerning the nature of human vision. At that time the term perspectiva, which was the Latin translation of Greek word *optikè*, meaning direct and distinct vision which revealed things, was also used to designate the pictorial technique. To distinguish them it was common to establish an opposition between "common" or "natural" perspective to perspectiva artificialis of painters. These two different expressions of perspectiva were held in different ways covering a broad spectrum of possibilities. However, these two expressions of knowledge turned gradually into different disciplines from sixteenth century onward. Optics and linear perspective began to redefine their research fields considering new theoretical issues which widened the gap between visualization (*visio*) and representation of space. Regarding this, this paper presents some aspects of the close connection between perspectiva naturalis and artificialis, based on a set of documents dealing with optics and linear perspective published in the sixteenth and seventeenth centuries.

History of Science; Optics; Perspective; Geometry; Space

Evolutionist conception in the series “La lucha por la vida” [The struggle for life] from the anarchist magazine Estudios [Studies] (1935)

Gilson Leandro Queluz, Universidade Tecnológica Federal do Paraná

Marilda Lopes Pinheiro Queluz, Universidade Tecnológica Federal do Paraná

This work intends to analyze some imagistic strategies used to build a conception of science and technology in the anarchist magazine *Estudios*, published in Valencia, Spain, between 1928 and 1937. This magazine was the most successful anarchist editorial experience in the period, encompassing topics as distinct as controversial, such as: naturist medicine, sex education, neo-Malthusianism, scientific and technological dissemination, eugenics, pacifism, anticlericalism, feminism, literature, art, among others. For Javier Navarro (1997), in his book *El Paraíso de la Razón* [The Paradise of Reason] (1997), this editorial line would be in accordance with an anti-dogmatic eclecticism, with the libertarian tradition of autodidacticism and with the intention of disseminating and establishing an emancipatory culture that would lead to a possibility of a society alternative to capitalism. In this regard, the magazine, according to Xavier Diez, – in *El anarquismo individualista en España (1923-1938)* [Individualist anarchism in Spain (1923-1938)] published in 2007 – will continue and will give new meaning to the anarchist tradition of reverence to science and technical progress, especially in the field of biology. This option was probably due to the wide participation of naturist doctors in its editorial board and to the option of combating the conservative hegemonic anti-evolutionist discourse of a religious nature. We will briefly present some of the main sections of the magazine and its graphic design, especially in the phase in which participated the graphic artists Manuel Moleón and Josep Renau from 1931 onwards. We will give greater emphasis to the analysis of the “La lucha por la vida” [The struggle for life] series, published between February and August of 1936, in the context of the Spanish Civil War, in which evolutionary theory is synthesized in short texts, illustrated by Josep Renau (1907-1982) and which occupy the space of a page. We will try to discuss how the relationship between text and image constitutes different layers of meaning about evolutionism in its imbrication with human development via science, technique, philosophy and art. In the illustrations the overlap of images, the montages seem to highlight the human knowledge accumulated over time; the plans of representation emphasize the importance of history, of knowledge about the past, approximating the scientific, technical and artistic knowledge materialized in the artifacts.

Revista Estudios; Anarchism; Evolutionism

The historical emergence of the diagnosis of hysteria in medical and psychiatric settings in the city of São Paulo, 1910–1960

Kurcgant Daniela, Instituto de Psiquiatria do HC-FMUSP

André Mota, Faculdade de Medicina da Universidade de São Paulo

José Ricardo de Carvalho Mesquita Ayres, Faculdade de Medicina da Universidade de São Paulo

Although hysteria was abandoned as a diagnostic category in the 1980s (APA, 1980; OMS, 1983), the term remains in medical parlance; it is, often pejoratively, used to refer to complaints and symptoms that cannot be explained by the biomedical model of illness. The concept of hysteria underwent myriad changes before becoming a medical category in the 18th century (Arnaud, 2007). Much of what was once subsumed under the umbrella term “hysteria” is no longer understood as such, while many manifestations currently conceptualized as hysteria were previously attributed to other conditions (King, 1998). In the late 19th century, psychoanalysis reoriented dissemination of the notion of hysteria. By the 20th century, a view would arise of hysteria as inseparable from psychoanalysis, as a contrast to declining medical interest in the concept (Trillat, 1991). The present

study sought to investigate the notion of hysteria in medical and psychiatric settings in the city of São Paulo, Brazil, from 1910 to 1960. São Paulo was chosen for its pioneering role as a seat of the psychoanalytic movement in Brazil and as the home of eminent psychiatrist Antonio Carlos Pacheco e Silva (1898-1988), who practiced during this period and had massive influence on Brazilian psychiatry, especially in São Paulo itself, through his academic, medical, and professional activities (Tarelow, 2011). From the 1910s, psychoanalytic ideas made inroads into the intellectual and cultural scenes of Brazil, particularly after Franco da Rocha published *O pansexualismo na doutrina de Freud* [Pansexuality in Freud's doctrine] in 1920 (Oliveira, 2006). However, in a struggle to distinguish itself from the traditional medical establishment of the Empire of Brazil, São Paulo saw the rise of a hegemonic age of experimental medicine, beginning in the late 19th century and extending into the 20th (Silva, 2014). From 1920 onward, Pacheco e Silva, influenced by his ties with the more conservative sectors of society (Tarelow, 2011), began advocating for a more scientific approach to psychiatry. In this sense, although the psychoanalytic movement arose in São Paulo around the same time that psychiatry became institutionalized as a medical specialty, psychoanalytic practice had little influence on psychiatric practice. The diagnosis of hysteria ultimately became less prevalent in psychiatric settings.

history of psychiatry; history of hysteria; history of science

Jardin des Plantes: a long-standing tradition of chemical textbooks

Lais dos Santos Pinto Trindade, Pontifícia Universidade Católica de São Paulo

In the end of the sixteenth century, Paracelsian ideas and medicines made from metals began to draw the attention of many French physicians, surgeons and apothecaries. Conversely, the Parisian Medical Faculty in particular not only refuted these ideas, but was also against the creation of a course of chemistry teaching how to prepare drugs obtained from the distillation of metals. Meanwhile, thanks to a royal protection granted by Henri IV of France, Jean Beguin (c. 1550-c. 1620) opened at Paris in 1604 a school of chemistry furnished with a laboratory. As a guide to his lectures, Beguin wrote the book "Tyrocinium chymicum," which became a model for similar publications. Soon afterwards, Paris witnessed the appearance of many independent courses of chemistry. Among them, the garden of medicinal herbs nowadays known as "Jardin des Plantes" proved to be the prototype for the teaching of chemistry throughout Europe. Founded in 1626 by Guy de La Brosse (1586-1641), physician to Louis XIII of France, this institution included in its faculty staff several renowned teachers and demonstrators. Practical classes were inaugurated there in 1648, following the appointment of Willian Davisson (1593-1669) as teacher of chemistry. Throughout the seventeenth century, interest in chemical preparation increased significantly, and many treatises on the subject issued by French printing-presses conquered readers across Europe. Such publications practically maintain the same structure. They begin with a brief introduction, in which the author explains the origins and the meaning of chemistry, and comments on elements and principles. Next, they describe chemical apparatuses and operations. And finally, they provide assorted preparations, divided into animal, vegetable, and mineral substances. Most of these books had a significant number of editions. This suggests that, although chemistry remained untaught at the Parisian Medical School, French chemical knowledge was steadily establishing itself. In the light of these events, the aim of this paper is to examine the influence which books written by scholars teachings at the "Jardin de Plantes" might have had in fashioning a long-standing tradition of chemical textbooks.

"history of chemistry"; "Seventeenth century"; "chemical textbooks"; "Jardin des Plantes"

Migration of images: visual information on herbs and chemical practices in Andrea Mattioli's commentary on Dioscorides

Maria Helena Roxo Beltran, Pontifical Catholic University of São Paulo

Books of distillation are one of the many types of texts created by the first editors. In fashion during the sixteenth and seventeenth centuries, they reached a wide audience, since they brought together at least two traditions concerning knowledge of herbs and other medicinal substances. For one thing, they preserved a scholarly tradition of texts that has its origin in Dioscorides' *Materia medica*. For another, they began to register popular knowledge concerning the preparation of remedies, originally preserved by women and transmitted by oral tradition. Furthermore, they emphasized and spread the idea that the powerful "waters" obtained by distillation were far more efficient than traditional lenitives, such as teas, decoctions, and syrups.

A remarkable characteristic of these books was the large number of images illustrating them. Woodcuts of stills, ovens, and other apparatuses used in the art of distillation are frequently reproduced on their pages. These images were supposed to help an illiterate public to follow the content of these books. Additionally, the practice of reproducing the same images in several parts of a book, in different editions of it, and even in works written by other authors has contributed to the establishment of visual standards related to distillation.

This process, which we call «migration of images», also comprises the incorporation into erudite herbals of sections initially belonging to books on distillation. That was the case of the commentary on Dioscorides' work composed by Pier Andrea Mattioli (1501-1577). Originally published in 1544, this herbal was reprinted many times throughout the sixteenth and seventeenth centuries. Its first edition brings only Mattioli's comments on Dioscorides' tract. However, apparently from the 1565 edition onwards, Mattioli's writing comprises an appendix titled "De ratione distillandi aquas ex omnibus plantis", which describes in words and images assorted apparatuses used in distillation. Analyzing that appendix is the aim of this paper. Particular attention will be given to its wide circulation, and the possible sources of the images in it.

History of science, history of books, science and techné, images in history of science, books of distillation

Francisco Pompêo do Amaral: doctor and academic in favor of food and nutrition as "synonymous of life"

Maria Lucia Mendes de Carvalho, Centro Paula Souza

This paper presents the professional and social trajectory of Francisco Pompêo do Amaral, a Brazilian of a traditional coffee growers family from the city of Campinas, as well as an academic of the Society of Medicine and Surgery of São Paulo. Francisco Pompêo do Amaral was born in Piracicaba in 1907, and joined the Faculty of Medicine of São Paulo in 1927. In this same year, he began working as a journalist, and graduated as a physician in 1933, with specialization in endocrinology. He started his career in the Pro-Infancy Crusade, following up the development of children in the Dom Pedro II Park, and researching in the institutional file to understand and disseminate the origin of child malnutrition. At the same time, between 1934 and 1938, he served as a teacher at the Superior School of Physical Education, and during this period, his academic and journalistic publications addressed the medical-hygienic aspect of physical education. In 1939, with an invitation from the Government of the State of São Paulo, he entered in the Superintendence of Professional Education as chief physician, and in this institution, he created the first course in the field of food and nutrition in Brazil for forming technicians in alimentation. The opening class of the course "Food Assistants" took place in May 17th, 1939 as complement to the curriculum of the course "Improvement for the

Formation of Masters in Domestic Education". Nevertheless, Francisco Pompêo do Amaral, with the support of the Superintendent Horácio Augusto da Silveira, pursued to transform it into a graduate course to form Dietitians. In 1953, this curriculum was dismembered, underwent revision in some curricular components, the name changed to "Dietitians", but course period remained lasting for two years. Pompêo do Amaral, with his team, left their place in the Carlos de Campos Technical School, in Brás, and occupied a building in the center of São Paulo to install the Scholar Food and Hygiene Service of the Department of Professional Education, where he remained as director of this course until 1958. In there, he developed studies and research that led to this physician two Official Awards from the National Academy of Medicine: in 1955, "The Food Problem"; and in 1956, "The Milk: National Problem", leaving a legacy with his retirement in 1961, nevertheless continuing his activities as a doctor, and, later, as a national correspondent of this academy. He died in São Paulo in 1990.

Professional Education; History of Dietetics; Food and Nutrition; National Academy of Medicine; Society of Medicine and Surgery of São Paulo

Physicians in the lab: chemical analyses of mineral waters in early 17th century

Rafael Donisete Bellettato, PUC-SP

The bond between chemistry and medicine became even straighter with the works of chemical physicians (or iatrochemists). As professor Allen G. Debus states in his *The English Paracelsians* study, part of the modern chemical analysis was developed from the analysis of medicinal spa waters. Paracelsus and his followers (even if not openly stated, once upon a time being called a paracelsian could be taken as an offense), had an important role in these studies. The search for the origins of the medicinal properties of baths, wells and lakes was an important subject, which led several physicians to the chemical analysis of mineral waters. In fact, we can find an increasing number of medical works bound up with bathing and mineral waters between the 17th and 18th centuries. Names such as the ones of Gabriel Fallopio (1523-1562), Andreas Libavius (1555-1616), Andrea Baccius (1524-1600), Leonhart Thurneisser (1531-1595) and Johannes Michael Savonarola (1385-1468) are among those whose proposed mineral experiments had a large influence in the chemical analysis of mineral waters. Edward Jorden (1569-1633), an English physician who in 1631 published a discourse on the properties of the waters from Bath in order to determine the presence and identify the minerals found there, was one of those who went through this influence. The aim of this work is to look into those experiments, see which ones were in use, whether they were qualitative or quantitative, and the explanations for their use, in particular of those proposed by Edward Jorden in his *Discourse of Naturall Bathes and Minerall Waters*.

Mineral Waters; Edward Jorden; History of Chemistry; Chemical Analysis; 17th Century

Libellus de Quinque Corporibus Regularibus: A geometry study of Piero della Francesca

Vagner Moraes, PUC-SP

The study of the regular geometric forms that appear in several paintings by Piero della Francesca, painted during the fifteenth century in the region of the Italian peninsula, brought the need to carry out a deeper analysis on the influences of Euclidean sources in the composition of the treatise *Libellus de Quinque Corporibus Regularibus*.

Looking at the Euclidean writings that came to the hands of Piero della Francesca (c.1420 - 1492), we

intend to understand how, and to what extent, such knowledge influenced the author in the composition of his aforementioned treatise.

Piero della Francesca was a painter and also stood out as a theorist of art. In addition to revolutionizing the aesthetic principles, he carried out research on pictorial, geometric and architectural issues. Of the treatises he wrote, only three remained on perspective (*Prospettiva Pingendi*), Geometry (*Libellus de Quinque Corporibus Regularibus*) and Arithmetic (*Trattado d'Abaco*).

The *Trattado d'Abaco* describes calculations that should be learned by merchants, that is, it brings notions of commercial and mercantile arithmetic, some comments on "algebra", and in the end, also, on geometry. This last theme will appear more deeply in the treatise *Libellus de Quinque Corporibus Regularibus*. From that, it is supposed that treatise was written before this and that it was the first of them, since the records of its studies appear in the first years in which it was in the School of the Abacus. The treatise *Prospettiva Pingendi* was written between the *Trattado d'Abaco* and the *Libellus de Quinque Corporibus Regularibus* and in it is a study on the perspective and in what way the painter could use it to carry out its work; This treatise was concluded before 1482, since it was given as a gift to the Duke of Urbino, Federigo da Montefeltro (1422 - 1482), for the latter to place in his library. The last treatise we know of today is the *Libellus de Quinque Corporibus Regularibus*, about regular and irregular geometric bodies, which bears a relation to the initial studies of geometry present in the *Trattado d'Abaco*, but with more depth in the arguments about its affirmations.

In order to reach such answers, the *Libellus de Quinque Corporibus Regularibus* treatise of the author cited will be used as documents and, as secondary bibliography, books and articles on the society in which the treatise were made, on the Euclidean writings developed and studied in the fifteenth century.

History of Science; Renaissance; Italy; Geometry; Piero della Francesca

Antiscorbutic medicines advertised in late Stuart Britain

Vera Cecilia Machline, Pontifical Catholic University of São Paulo

The subject-matter of this paper is an innovation in antiscorbutic preparations advertised by means of leaflets and brochures in late Stuart Britain – a time period taken to correspond to the second half of the seventeenth century. Like most former pharmaceutical advertisements, the promotional material to be analyzed here comprised, among other characteristics, the following ones: the use of testimonials; innuendos discrediting competitors; a list of symptoms to help prospective customers to diagnose themselves; a table of the places where the compound could be purchased; and claims for the cure of widely different illnesses. A good example of the last feature is Humphrey "Nendick's Popular-Pill," supposed to be good "against all chronic diseases," particularly "the scurvey." A second nostrum equally marketed in the 1670's was John Holney's "Universal Pill." Presumably, it cured dropsy, jaundice, leprosy, king's evil, and green sickness; moreover, in addition to scurvy, "any other Chronick Distemper whatsoever." Nowadays a laughingstock even among historians, these and other cure-alls actually had a physical foundation: they derived from the long-standing belief that the same humoral unbalance occasioned various diseases.

Apparently beginning in 1680, a new line of antiscorbutic drugs arose. Advertisements disclosed that these remedies contained scurvy grass in distilled form. That was the case of Robert Bateman's "Spirits of scurvey-grass," allegedly "Famous throughout the Nation for their Admirable Effects on Scurvy, Dropsy and several other Distempers." The emergence of formulas with scurvy grass in Britain may have been fostered by the publication, in 1676, of the English translation of the book "*Cochlearia curiosa*," written by the Leipzig natural philosopher Andreas Valentin Moellenbrock (1623-1675). As shall be detailed in this paper, that work provides many recipes of compounds with scurvy grass. Moellenbrock imparts that this herb encompasses a group of "hot and dry" plants, whose "chief efficacy" resides in its "volatile Salt," which "is profitable against the Dropsie," but "chiefly" in the cure of "Scurvy and its Symptomes." The seeds of such herbs, in particular, were "effectual in expelling by sweat the small Pox, and Measles." More importantly, Moellenbrock

advocates that the “volatile Salt” proper to scurvy grass was not lost when its leaves and seeds were distilled. (FAPESP, Grant n. 2011/14040-9)

Late Stuart Britain; Antiscorbutic medicines; Pharmaceutical advertisements; scurvy grass; Andreas Valentin Moellenbrock

076. Electric energy in history: social, economic and cultural issues

The powerful consortium: the case of Brazilian Traction

Alexandre Ricardi, Universidade de São Paulo

This communication is part of the doctoral research on the Brazilian Traction created in 1912 in Toronto, Canada, holding that brought together the most successful companies in Brazil, the São Paulo and Rio de Janeiro Light and Power, and the São Paulo Electric Co. who built 1911 - 1914 the Itupararanga plant in Sorocaba, to provide electricity to the city of São Paulo, ensuring concessions in others cities. In turn, the Brazilian Traction was controlled by Canadian and General Finance Company Limited, as Barcelona and Mexico Traction, others companies of the “Pearson group”. We bring here the propositions that took place in Canada about public electric power that resulted in the creation of the Hydro-Electric Power Commission of Ontario to distribute energy, 1906, and in the authorization to generate energy, 1914. The political action mobilized the Canadian public opinion and, in Brazil, alarmed the directors of São Paulo and Rio de Janeiro Light and Power, who feared the spread of proposals that would threaten the recently acquired monopoly, leading to the creation of Brazilian Traction. Two assumptions must then be verified, whether such strikes really generated pressure that led to the merger of companies in Canada and Brazil, because the controllers feared processes of nationalization; and if there were consonances with the Brazilian proposal initiated by Alfredo Valadão, 1904, but only approved with modifications in 1934.

Brazilian Traction; Public utilities; Light and Power; Electricity

Hydroelectricity in Portugal: technical expertise, mobility of engineers, transfer of technology and landscapes of technical innovation

Ana Cardoso de Matos, Universidade de Évora CIDEHUS

The construction of dams in Portugal was directly linked to the country's hydrographic network and demanded a series of engineering-related expertise), particularly in the field of strength of materials and construction techniques. Aspects that were directly connected with the development of engineering education in Portugal, the transfer of technology and the creation of specific laboratories where it was possible to conduct studies and to test material resistance.

At first it was necessary to contract foreign technicians to construct the great dams. Only in a second phase did the development of Portuguese engineering and the support of research and experimentation structures, such as the National Civil Engineering Laboratory (LNEC), allowed these works to be carried out by Portuguese engineers.

The construction of the large dams resulted in a new landscape that was marked not only by the dam itself, but also by changing the course of the river and the creation of a water reservoir. The technical expertise that this construction required and the impact it had on the pre-existing landscape was so great that we can consider these landscapes as landscapes of technical innovation.

The construction of infrastructures and equipment needed to support the works, as well as

neighborhoods where the workers were housed during the construction of the dam, as well as the clearing of land and the various phases of construction of the huge wall of water support created "temporary landscapes" that after were mostly submerged with the filling of the reservoir. By submerging the old paths and the roads, the dams forced the construction of new roads and traced new routes in the mobility of the populations.

This communication aims to address the issues mentioned above.

landscape, hydroelectricity, dam, technical innovation, Portugal

Railway Heritage and Networks of Tecnological Knowledge

Ana Carina Urbano Torrejais, Universidade de São Paulo

In Brazilian industrial society, the development of the railway sector occupied a prominent position, especially until 1960's, at which point the road transport would be considered a suitable alternative to the country's economic growth. However, between the end of the 19th century and the early 20th century, the rail modal, radiating from the coast to the interior of São Paulo State, guaranteed the territorial occupation and the coffee expansion until 1930. The capital investment in the railway sector has been one of the priorities of the national economy, which sought to remain aligned with the technological development of the sector. Later, between 1930 and 1960, the rail modal continued to serve freight and passengers, ensuring the financial investment.

Therefore, the development of the railway sector comprises the macrostructural analysis of Brazilian industry and the networks of technological knowledge, maintained as part of this policy development. In particular, the transition between different systems of energy productivity, lead to the restructuring of modal and industrial complexes related to railway maintenance, with a strong impact on organization of spaces and equipment officers, as well as on professional management of the sector. Peculiar to the case of São Paulo, was the transition processed between the mechanical and electrical systems of energy productivity, during the 1920's, which would bring several implications in the managing of railway maintenance complexes.

An interesting case is the maintenance workshops of the Companhia Paulista de Estradas de Ferro, located in Jundiaí (State of São Paulo, Brazil). The period of operation by the Paulista ran from 1896 to 1971 and, over the years, the workshops would through a restructuring process, particularly in the transition from mechanical to electrical power supply of industrial equipments, which would from 1905. The analysis of the main implications from this process, is also dependent on the internal organization of different official sections, in conjunction with the structure of buildings, maintenance and space arrangement of workbenches. In this context, the concepts of invention, innovation, obsolescence and resilience acquire particular relevance, by allowing explain the continuity and maintenance of these infrastructures and equipment, in relation to the different technological systems adopted.

Railway Heritage; Maintenance Workshops; Networks of Technological Knowledge

From the SHC (Small Hydroelectric Centrals) to the huge hydroelectric projects: the energetic development in the West border of Brazil

Andrey Minin Martin, Universidade Federal do Sul e Sudeste do Pará

This work aims to explain considerations about the ways of the Brazilian energetic sector between the decades of 1950 and 1970 and its impact as a driving force in the West area of Brazil. This region

was historically permeated by different technic and technological incursions, and it was marked by elements such as the telegraph and the railway. It would find, from mid-fifties, new transformers agents, in this case, they were linked to the energetic sector. For this analysis it is centered in the development of the Urubupuga Hydroelectric Complex. That was established from the construction of two huge hydroelectric plants, the Engenheiro Souza Dias Hydroelectric Plant, and the Hydroelectric Plant of Ilha Solteira. This enterprise was planned and implemented between the fifties and mid-seventies, through new experiences of regional planning, in this case, at the same time as the creation of the CIBPU (Interstate Commission of the Paraná-Uruguay Basin). This regional planning project pervaded through seven national states, having the influence of the American experiences of the Tennessee Valley Authority, TVA. To this analysis, from the theoretical-methodological debate between memory and press to a wide range of documents, like meetings minutes, CIBPU and CESP documents, and journals of national and regional circulation, it is presented a series of narratives about the implementation and needs of the enterprise its ideology of progress and a new image to the region, all of this before the beginning of the construction work. This initiatives deeply changed the ways of life, the landscapes and the political-social relationships in the hinterlands of Brazil, that were connected directly to the construction of memories about this historical time, relegating the small hydroelectric centrals to a background or even to disappear. In this way, private interests, disputes for the legitimacy and power, and in this way, memories were built in this period and marked the construction of the hydroelectric complex until its completion in the seventies, establishing relation to memories landmarks from the past and leaving developments for the future.

Hydroelectric plant; Development; Brazil; Urubupuga Hydroelectric Complex; Memory

Transnational Reactions: How International Organizations perceived National Anti-Nuclear Protests and responded to them

Christian Forstner, Friedrich Schiller University Jena

This paper examines the Austrian Anti-Nuclear protests and their perception by the International Atomic Energy Agency at the end of the 1970s. The entanglement of physical research with government, politics and industry as well as the public negotiation of science, reached a qualitative new dimension during the Cold War. As a small politically neutral state in the Cold War, the characteristics of this process are significantly more pronounced in Austria than other countries. First, the interdependence of national research programs with transnational organizations as the International Atomic Energy Agency, which is based in Vienna, second, new research concepts beyond academic laboratory science, which lead to new interaction examples between government, science, industry and society and third, major technologies that have been subject to new social evaluation criteria up to now. These emerging structures can be traced in the defined framework of Austria in a detailed manner, ranging up to the establishment of a national nuclear energy program. As John Krige pointed out, a transnational network with the United States as a hegemonic junction was dominant at the beginning of the Cold War, but the smaller inner European networks experienced an upward revaluation in comparison to the transatlantic networks within the scope of the construction of Austria's first nuclear plant at the beginnings of the 1970s. From the beginnings of the decade local anti-nuclear protest groups grew up to a broad national movement against the construction of the Austrian nuclear power plant in Zwentendorf. The IAEA initially hardly took notice of the early protest groups. This changed after public pressure increased and led the Austrian chancellor Bruno Kreisky to announce a referendum in mid-1978, which finally stopped the by then completed power plant in Zwentendorf from going critical. Driven by the events in Austria the IEAE initiated workshops to develop strategies to prevent that the local Austrian spark escalated to a conflagration. In my analysis I am trying to bring two narratives: The analysis of national narratives for building up a big picture through the perspective of global history to

understand the interaction of academia, government, industry, and the role of the public from the perspective of a historian of science.

Nuclear Energy; International Atomic Energy Agency; Austria; Anti-Nuclear movement

Public works photographs from the Archives of the Energy Heritage Foundation

Eduardo Romero de Oliveira, São Paulo State University (UNESP)

The nineteenth century photographers produced images for many purposes; in particular, we direct our attention to photographs picturing public work. Although it is possible for them to have aesthetic quality, these pictures were taken as a technical record of the main elements built or to show the evolution of the construction. The photographer Guilherme Gansly produced relevant material of engineering and architectural works, which highlight the services provided by the São Paulo Tramway Light and Power Company, in terms of infrastructure and construction of tramway tracks (1899-1925) – this company was controlled by the same trust as the Rio de Janeiro Light and Power Company. The main objective of this presentation is to focus on this iconographic document, not only as urbanism documentation, but also as a technological record (rails, overhead lines for street trams, electric street lights), guided by a pattern of visual effect ("urban views").

Tramways; Electricity; Photographs; Public Work; Engineering works

Hydroelectricity in São Paulo State: memory and challenges

Gildo Magalhães, University of São Paulo

The Electromemory Project surveyed the sites of hydroelectric generation in the State of São Paulo, whose first plant dates back to 1893. The initial idea was to find unknown archival material stored in the several power units scattered around the state. Field trips to the sites were conducted, including a representative set of power stations and substations built by private enterprises between the advent of the Republican era in the 1890's and the age of governmental companies, which started in the 1950's, and ended with the neoliberal privatization at the end of the 20th century. Much material was found, including technical reports, drawings, photos, movies, etc., confirming that their existence was largely ignored by the present owners. Quite a number of power units still operate with exceptionally long-lived equipment. There is ample variety of themes relative to economic and social history of the state, and some of this has already been incorporated in articles and dissertations.

The re-privatization of electric companies, which has been going on for the last 20 years, signified also the denationalization of the sector. The auctioned concessions do not foresee any commitment of the new owners towards maintaining the companies' memory. It is uncertain, to say the least, what will happen with the existing material uncovered by the present research.

The project also surveyed the museological potential associated with the power facilities, and in connection with other local museums. Concepts of industrial archeology and heritage were employed to envision touristic opportunities afforded by the scenery around the plants.

Another project activity was the analysis of environmental impacts that resulted from the implantation of dams and power stations. One general conclusion is that, although some destruction resulted, in several cases the power stations did help to protect the remains of original vegetation, and to control the water flow during floods and dry seasons. However, the main threat to the environment is not the power stations themselves, but the dramatic pollution of the rivers, whose waters carry so much sewage and trash as to affect the operation of the generating units, as well as

harming landscapes that would otherwise be splendid sightseeing opportunities. The last part of the project was the construction of a public accessed data bank containing the main results of the project.

History of electrification; environmental impact; archives; industrial heritage; museology

Sources for the History of Electrical Energy: archival documents of the first hydroelectric power plants in São Paulo - Brasil

Marcia Cristina de Carvalho Pazin Vitoriano, Univ. Estadual Paulista "Julio de Mesquita Filho"

Electrical energy began to be implanted in the State of São Paulo in the last decades of the 19th century. For more than 60 years, the implementation of plants by private companies has prevailed, producing a group of small hydroelectric power plants that is spread throughout the state of São Paulo. Archival documents, when preserved, constitutes an important part of the industrial heritage represented by these plants. From its analysis it is possible to understand many of technical and operating characteristics, even after the disappearance of their original equipments. Thus, the objective of this paper is to present an overview about documents with historical value found in archives in 50 power plants studied. For this purpose, we used collected data during field research carried out in the expeditions for the Thematic Project: History of Electric Energy in the State of São Paulo (1890-1960): Industrial Heritage, Landscape and Environment. The aim is to identify possible contributions of these archives to development of research in the context of the History of Technology in the 20th century.

Industrial Heritage; Archival Documents; Hydroelectric power plant; Business Archives

Industrial heritage and musealization – theme reflections about the small hydroelectric power plants of São Paulo, Brazil

Marilia Xavier Cury, Archeology and Ethnology Museum of the University of São Paulo

Initiatives aimed at and discussions about the preservation of Brazil's industrial heritage still focus on railways and trains. However, the electricity industry poses us contemporary issues that are emerging and can be the subject matter of academic research by applying the concepts of heritage collection and musealization, which we wish to make evident. To that end, the purpose of communication is to contribute for the discussion about how small hydroelectric power plants (or PCHs, the acronym in Portuguese) can be understood as industrial heritage, and can be qualified and recognized as in situ museums. This presentation will address a study about the musealization potential of a total of 62 PCHs in the state of São Paulo which started operations between 1880 and 1960. The study considered that "musealization" should involve the small hydroelectric power plants in use, without affecting their energy generation activities. The methodology consisted of drawing a roadmap to identify material heritage milestones (architecture, machinery, landscape, documentation, etc.) and immaterial heritage milestones (biographies of entrepreneurs, work culture, sociability, memories, etc.) and to evaluate the access of visitors, given that the study was based on circulation/exposure scripts and learning. The data to be presented basically consist of the themes allowed by the PCHs to be articulated by museal communication: Colonization of the state of São Paulo, industrialization and energy; history of energy and development in the state of São Paulo; technologies and energy generation; electricity industry professions and professionals; entrepreneurship in the electricity industry; PCHs and the preservation of the landscape; water and

electric systems; energy production today and the small hydroelectric power plants' share in it; PCHs and hydroelectric power plants; electricity and consumer society; energy and new technologies. The presentation aims at making PCHs the subject matter of academic research, whether each small hydroelectric power plant locally, whether the whole set of PCHs and at articulating them as much as possible as the state of São Paulo's heritage to be recognized.

History of Energy; Museum; Museum in situ; Musealization; Museological Communication

The public perception of nuclear energy (2007-2014)

Marly Iyo Kamioji, University of São Paulo

There has been a revival of interest in nuclear power as an option to meet rising electricity consumption. However, this source of energy still faces public resistance to accept it. Pressures of the anti-nuclear campaign turned the public against to even its civil use after the famous Three Mile Island and Chernobyl plants accidents. It is important to understand how the public image of nuclear technology is moulded by several actors. Is the media considering all the involved actors? How do they make that choice? Are the accidents the only major events? Besides politicians, nuclear industry investors, and scientists, the environmentalists have had a major role in the issue. Several kinds of public discourses and types of media such as debates, documentaries, TV news, blogs, online and printed news will be presented to analyse the public perception of nuclear energy.

electric energy, nuclear reactor, public perception, environmentalist, science and technology

Overview and perspectives of the electricity sector musealization in São Paulo state (Brazil)

Mirian Midori Peres Yagui, Secretaria da Cultura do Estado de São Paulo

This paper proposes to address issues relating to museum collections with industrial heritage of electric sector identified in museums located in cities close to Hydroelectric Power Plants, triggering the weakness in understanding what to preserve for the memories and local identities, and the importance of hydroelectrics for the development of municipalities and São Paulo state. It reflects on the situation in situ and the potential musealization of hydroelectric plants that present possibilities of museological models based on new museology and on the conception of territory/ landscape. This search also discuss the implementation and operation of the Museum of Energy, which has become a benchmark in the preservation and, more specifically, in musealization of the electricity sector heritage of São Paulo state in situ and classic museums. So we put in debate prospects for the preservation of the power sector in the state of São Paulo through musealization.

Industrial Heritage of Electric Sector; Museum of Energy; Hydroelectric Power Plants; Musealization; São Paulo

The electrification of everyday life in Denmark, 1950-1973

Mogens Rudiger, Aalborg University

The Danish welfare state was established in the decades following World War II. In this process, energy played a crucial role in translating the welfare policy into ordinary people's everyday life and making home life more comfortable and convenient.

During the 1950s and 1960s, Denmark experienced a veritable boom in detached houses and standard houses that conquered the agricultural land and turned it into suburban areas. The new houses were all energized. Electrical appliances invaded the new homes. The number of power sockets along the floors increased, the kitchen was electrified and loaded with a vast number of electrical appliances, and soon the washing machine and TV-sets had become necessities in the modern home.

In this paper, I address how this electrification affected everyday life and created a new energy culture, and how the electrification was embedded in a new understanding of modernization.

electrification; everyday life; energy culture

Nuclear news: electricity and science diffusion

Nuno Luis Madureira, ISCTE-IUL

This paper shows that the British press was totally unprepared to deal with the themes that came into the limelight after second World War: nuclear bombs and nuclear power. To satisfy avid readers, newspapers adopted a variety of "copy-paste journalism", in which the official views were echoed by the press and leading public service personalities were enrolled to write articles and fill the knowledge gap. As a result, all the important issues that affected the British nuclear industry were concealed and misrepresented. By the close of the 1950s the internalization of scientific news was assured through the surfacing of three different types of newspaper reporting: the everyday journalist, significantly labelled "lobby journalist"; the scientific correspondent sited in Britain and abroad; the opinion-maker. Drawing on different data sources it is shown how atomic fission came to be represented by the press.

electricity, nuclear, science diffusion

Railway electrification under debate

Sérgio Felix Pires, University of São Paulo

This work aims to investigate the debates about the railway electrification projects during the period between 1922 and 1963 between engineers and technicians, with the focus on investigating whether the railway electrification was understood in a hegemonic way as a project of modernization and progress and if projects like These were considered viable and necessary for the needs of rail transportation in Brazil, particularly in the state of São Paulo. Specialized periodicals from the Engineering Institute of São Paulo and the Engineering Club of Rio de Janeiro will be used for this research, in addition to the publications of the Polytechnic Periodical of the University of São Paulo.

Electrification; Railroad; Engineering; Debates; Projects

077. Global Underground: Circulations of Knowledge and the Sciences of Mining in the "long" 19th Century

Coal mining and technological change in colonial Australia: 1789-1914

Adam Lucas, University of Wollongong

Coal was first discovered to the north and south of modern Sydney in the 1790s, within only a few years of the first British colony being established there in 1788, although it was not until the early 1800s that the resource began to be exploited.

The bituminous coals that were found in what are now known as the Hunter and Illawarra regions had a high energy density and carbon content, and were initially used primarily for heating and some metallurgical processes. With the expansion of the new British settlements into what are now the states of Tasmania, Victoria, Queensland, South Australia and Western Australia, the identification of secure fossil energy sources for heating, lighting, transport and industrial processes was seen to be of increasing economic and strategic importance. Until the states federated in 1902, most preferred to ensure their energy self-sufficiency rather than trading energy commodities with their neighbouring sovereign states. Being a British colony, coal mining techniques and technologies in Australia were, unsurprisingly, almost exclusively adopted and adapted from England and Wales. Both countries had well-established coal mining industries going back to Roman times, although the main techniques of underground coal mining were developed in the late 1700s. This paper outlines the establishment of new techniques, technologies and know-how in the fledgling Australian coal industry, including the creation of schools of mines, trades, geology, chemistry and engineering by state governments, as well as the formation of the first Australian trade unions, and to what extent these developments were dependent on existing British models, or were drawn from other national cultures, or indeed were local innovations. The paper will draw on historical and sociological studies of empire and technology transfer to examine the extent to which the expansion of coal mining in Australia underpinned broader colonial ambitions regarding the expansion of British influence throughout the Australian sub-continent and in the Asia-Pacific region more generally.

coal mining, colonialism, technology transfer, innovation

Knowledge about coal and the transformation of energy systems in Mexico and Cuba in the nineteenth century

Helge Wendt, Max Planck Institute for the History of Science

The history of coal and coal mining is a rather underrated issue of histories of mining and industrialization of Latin America. This contribution will present two case studies from Cuba and Mexico, connecting intended and realized coal mining enterprises with “national”, “trans-colonial” and international histories of geology and the history of industrialization. Furthermore, 19th-century international politics and political and economical expansionism will play a central role.

Coal had played a central role in the establishment of modern and imperial colonial empires. The new, steam-engine driven maritime traffic was fundamental to colonial expansion – only now streams and rivers could be navigated. Partly, the British colonial expansion from 1800 onwards intended to secure ports where coal for supplying ships could be stocked. In the 1840s increasingly the exploitation of geological coal deposits in the colonies or in regions that were turned into colonies was organized. Also the US expansion to the West was related to coal, as the construction of railways was meant to secure the new territories. In the Rio Grande region geological surveys discovered coal and lignite fields: the exploitation of those deposits were either secured by military campaigns or by capital investments. In other parts of Mexico, local initiatives of industrialization

could make use of newly discovered coal deposits, exploited often by small joint-venture companies of national and international capital. In Cuba a small deposit of carboniferous material was discovered. The extracted matter was meant to foster industrialization processes on the island: copper smelting, sugar refinery, steam engine, and iron working. Later, an error of chemical analysis was revealed and rather than coal the matter was defined to be asphalt.

The paper will focus on how coalmining is historically related to political, socio-economical and epistemological contexts. Additionally, a basic question is how local conditions stimulated and confined and local dynamics transfer and gaining of knowledge as well as to set up an energy system based on fossil fuels.

Coal Geology Mexico Cuba

Transatlantic Ties. European Mining Experts in the Spanish and Portuguese Empire around 1800

Jakob Vogel, Sciences Po Paris

Mining history has for a long time acknowledged the important role that scientifically trained Spanish mining officials like the brother Juan José and Fausto d'Elhuyar played for the development of the mining industry in the Spanish Empire around the turn of the 18th to the 19th century. Since the 1780s, in the context of the Bourbon reform movement that tried to implement new mining knowledge in Latin America, mines in Mexico, in the Vice-Royalty of New Grenade but also those in Peru were subject of innovations undertaken in a cameralist spirit that the Spanish experts shared with their European counterparts of the time. The voyage of Alexander von Humboldt in the different Spanish territories took place beyond the backdrop of this shared epistemic culture that was coined more or less after the model of the "mining sciences" taught at the Saxonian mining academy in Freiberg.

Much less known in this context are the parallel efforts made by the Portuguese Empire at the same time to modernize the mines in their Brazilian territories drawing also on contemporary European scientific knowledge. Even before 1807, date when the Portuguese king and his court moved to Rio de Janeiro, the government in Lisbon contracted an British mineralogist, John Mawe, in order to gather geological knowledge that should help to develop the mining industry in the Empire. Mawe's travel to the southern and centrals parts of Brazil had some political implications in the context of the dispute with Spain about the Rio de la Plata-Region. Later, the government invited experts from Sweden and German countries to Brazil with the same goals.

In this perspective, the paper compares the different strategies employed by the two imperial governments to modernize the mining industry of their respective Empire with the help of national and foreign mining experts and scientists. It will highlight both the similarities of their endeavors and the peculiarities of the Portuguese-Brazilian case, where political interferences seems to have been much more important than in the Spanish empire.

Mining Sciences; State Knowledge; Histories of Empires; History of Expertise; European-Latin American Connections

Surfaces in Competition: Coal in Late 18th Century Catalonia

Nuria Valverde Pérez, Universidad Autónoma Metropolitana-Cuajimalpa

In 1795, the deforestation produced in the surroundings of Liérganes (Cantabria)—a most visible effect of Spain's progress in shipbuilding—led to the closure of this historical blast furnace. From 1769

on, the authorities focused on the exploitation of some coal basins in the North of the country. Almost a half of the nowadays known coal basins in Spain were discovered during the last quarter of the 18th century. However, the levels of production were low. The mines of Asturias, one of the most important coal basins, never reached more than 1,500 MT a year before 1786. By 1792, the Royal Mines of Langreo, in the Asturian basin, produced almost 5,000 MT of coal per year (Coll & Sudriá 1987, 20, 29).

Two factors usually explain the underdevelopment of the domestic coal market. Firstly, the orography of the country posed huge challenges to the possibility of circulating it, making the resulting industrial products very expensive. Secondly, most of the technological infrastructure, such as furnaces, were adapted to charcoal or wood combustion, not to coal or coke combustion. As the Real Factory of Artillery of La Cavada-Liérganes (Cantabria) failed to adapt its blast furnaces to coke, the demand of coal never skyrocketed as expected. However, although the Navy was the most important client for coal, it was not the only one. By 1763, some small industries used coal imported from England. By the end of the century, a quarter of all the homes in Madrid used coal for cooking. (Coll & Sudriá 1987)

Catalonia became to experience shortages of timber, and hence of charcoal, from 1770 on. Multiple factors contributed to it, though. For instance, by 1750 the extension of vineyards increased, making the scarcity of timber even more compelling and irreversible. Nonetheless, vineyards became one of the main assets of the Catalanian economy; wine and liquor accounted for 53.30% of all exports to the American colonies between 1756 and 1785. (Oliva Melgar 1987) The discovery and exploitation of the mines of San Juan de las Abadesas in 1785—with an annual production of 1,500 MT, immediately began to supply to one hundred forges in the Ripoll area. In addition, several glass factories were established in the area as well.

By analysing the peculiar circumstances of the Catalanian coal mining, this contribution aims to clarify how epistemic, geological, technological and bureaucratic orders combined to produce a particular industrial, environmental and cultural landscape.

mining; epistemic cultures; limited resources; 18th century

078. Les ingénieurs autour du monde: mobilité des personnes, transfert des techniques, diffusion de savoirs (XVIIe-XXe)

Politiques d'État, circulation et carrière: les ingénieurs du nucléaire et de l'informatique au Brésil, 1950-1980

Flavio M. Heinz, UFRRJ

Dans le cadre d'une recherche plus étendue, consacrée à l'histoire sociale du personnel scientifique des ministères et des agences étatiques qui ont participé à la définition et implémentation des politiques technologiques et industrielles brésiliennes, des années 1950 jusqu'aux années 1980, dans les secteurs stratégiques du nucléaire, de l'informatique et des télécommunications, nous cherchons à: (a) repérer - et en identifier les traits généraux - la présence d'ingénieurs étrangers et d'ingénieurs brésiliens qui ont été, total ou partiellement, formé dans des universités étrangères, notamment en Europe et dans les États-Unis; (b) déterminer l'importance de leur circulation internationale pour leur carrières (en termes de longévité et des positions occupées dans l'hierarchie, par exemple) dans les programmes stratégiques de l'État, surtout ceux du nucléaire et de l'informatique.

Ingénierie; circulation; politique nucléaire - Brésil

“Nous avons obtenu de la Hollande d’excellents ingénieurs hydrauliciens », ou la « Deuxième vague hollandaise » en Russie (1783-1818/36)

Gouzévitch Dmitri, CERCEC, Ecole des Hautes Etudes en Sciences Sociales

A la différence des experts techniques hollandais embauchés à l’époque pétroviennienne, dont le rôle a été bien étudié, celui des ingénieurs hollandais ayant exercé en Russie un siècle plus tard, -et connus dans l’historiographie russe comme la « Deuxième vague hollandaise »-, est beaucoup moins exploré. Or, l’apport collectif de ces experts dans l’essor de l’ingénierie et dans la modernisation technique en Russie au sens large est essentiel à plusieurs égards et de ce fait, mérite sans doute d’être étudié de manière approfondie. Pour ne rappeler que leurs plus grandes réalisations, il suffit de mentionner une quinzaine de villes et places fortes au nord de la Mer Noire, à commencer par Odessa et Sebastopol ; deux grands systèmes navigables – Tihvinskaja et Mariinskaja qui ont relié Saint-Pétersbourg avec la Russie centrale et méridionale et assuré ainsi l’approvisionnement continu de la capitale impériale excentrée ; trois établissements techniques militaires de très haut niveau ; la non-participation de la Suède dans la campagne de 1812 du côté de Napoléon ; des milliers de livres et de manuscrits ; des collections d’œuvres d’art, etc. Ce bilan imposant fut l’œuvre d’une trentaine d’individus dont l’auteur de la présente communication se propose de dresser un portrait collectif. Y seront examinés les origines, les parcours, les compétences et les travaux de quatre groupes de spécialistes classés selon leur degré d’implication dans l’œuvre technique et l’action modernisatrice (y compris politique et diplomatique) en Russie sous quatre règnes successifs, de Catherine II à Nicolas I, une implication pouvant aller de tâches routinières et limitées dans le temps aux contributions magistrales engageant à vie des ingénieurs de grand talent et de tempérament fulgurant. Deux portraits individuels seront ensuite esquissés pour présenter les personnalités les plus distinguées, telles que Franz Dewollant et Peter van Sukhtelen, grands promoteurs de l’enseignement technique en Russie. L’auteur s’attachera, enfin, à répondre à la question souvent posée : pourquoi les Hollandais ? et à analyser l’un des plus grands paradoxes de la « Deuxième vague hollandaise » : leur invitation visant à éviter à s’investir dans la formation des ingénieurs nationaux, et leur action de fin de carrière visant clairement à promouvoir ces formations dans les grands domaines de l’ingénierie – le génie militaire, la cartographie et les travaux publics

Ingénieurs hollandais; Russie; XVIIIe et XIXe siècle; écoles d'ingénieurs

Les polytechniciens français à Saint-Pétersbourg: l’esquisse d’un portrait de groupe (XIXe siècle)

Gouzévitch Irina, Centre Maurice Halbwachs, Ecole des Hautes Etudes en Sciences Sociales

Plus de 40 polytechniciens ont exercé en Russie durant le XIXe siècle, et 16 parmi eux ont excellé à Saint-Pétersbourg. Certains sont venus sur l’invitation du gouvernement pour entrer au service de la Couronne, d’autres s’y sont rendus de leur propre chef ou sur l’invitation des particuliers pour exercer dans le privé. La plupart sont rentrés en France, quelques-uns se sont naturalisés en Russie. Mais tous ont exercé leur métier d’ingénieurs. Malgré la diversité des caractères et des parcours, ces gens possèdent un certain nombre de caractéristiques en commun qui font d’eux, en fin de compte, une constellation d’individus à la fois spécifique et identifiable parmi tous. C’est ce groupe d’ingénieurs que nous souhaitons présenter ici collectivement et individuellement, en offrant un survol en deux temps. Nous nous attacherons d’abord à faire un aperçu typologique de leurs parcours (carrières et réalisations, états de service et de mérites, action politique et sociale, sociabilités, mondanités et réseaux). Ensuite, nous allons analyser leur apport collectif dans la culture technique russe. Cet apport est difficile à surestimer. Il concerne en effet la plupart des domaines d’intervention propres à cette profession : projets et calculs des constructions, conduite et

direction des travaux (ouvrages d'art isolés et projets d'envergure nationale) ; aménagement, embellissement et hygiène urbaine ; administration ; enseignement ; recherche ; édition (manuels, traités savants et périodiques). Pour terminer, nous offrirons quelques portraits hauts en couleurs de personnalités distinguées : Pierre-Dominique Bazaine, Gabriel Lamé, Benoît Paul Emile Clapeyron, Frédéric Le Play dont les activités professionnelles en Russie ont eu un impact sur la culture technique et savante française.

Polytechniciens; Russie; XIXe siècle; culture technique; ingénieurs

Transfer of knowledge versus local appropriation: Manuel Guimarães and the emergence of “Spherical Astronomy” in early 19th century Rio de Janeiro

Luís Miguel Carolino, ISCTE - Instituto Universitário de Lisboa / CIES

In 1814, Manuel Ferreira de Araújo Guimarães (1777-1838), at the time sergeant of the Corps of Engineers of the Portuguese army, published in Rio de Janeiro 'Elementos de Astronomia para uso dos alumnos da Academia Real Militar' (Elements of Astronomy for the use of the students of the Royal Military Academy). This book, which was one of the first textbooks to be published in spherical astronomy, a branch of astronomical science that was in the process of becoming an autonomous discipline, was the result of a transfer of knowledge. Born in Bahia, Brazil, Guimarães moved to Lisbon in order to study at the Navy Royal Academy. In Lisbon, Guimarães embarked on a prolific career as translator of scientific books. His studies together with his translation activity made him familiar with the most recent astronomical books published in Europe, namely the textbooks authored by Jean-Baptiste Biot and Samuel Vince. Nevertheless, while composing his own astronomical textbook, Guimarães went beyond these standard books. In this paper, I argue that local conditions related with the move of the Portuguese Court to Rio de Janeiro (1808) and the urgent need to train the state's technical and scientific elite led Guimarães to compose a different sort of book. A study on Guimarães's Elementos de Astronomia demonstrates thus that transfer of knowledge was concomitant with process of appropriation of scientific knowledge and techniques.

Knowledge transfer; Manuel de Ferreira de Araújo Guimarães; Spherical astronomy; Science teaching

Some aspects of Euler's contributions in his first stage in Saint Petersburg

M. Rosa Massa-Esteve, University Polytechnique of Catalonia

Leonhard Euler (1707-1783), considered one of the most prolific mathematicians in history, at the beginning of his scientific life, moved from Basel to Saint Petersburg Academy of Sciences, founded by Peter I in 1724, and remained there during fourteen years. He arrived to Saint Petersburg with 20 years, collaborated actively in the Academy and became one of its principal promoters. In addition, he improved his research with the contact with others academicians that worked in Saint Petersburg. In his works, Euler presented the mathematics connected with the applications to the other science matters, to the technological problems and to the public life.

However, perhaps his more important contribution was his works that constituted the starting point for the development of Analysis. During the precedent century, two of the most important advances in the practice of mathematics had been the foundation of what now we call analytic geometry and the development of the infinitesimal calculus. Both fields attained their exceptional power by establishing connections between algebraic expressions and figures, and between algebraic operations and geometrical constructions. This process of algebrization of mathematics was

developed primarily, on one hand, by the works of René Descartes (1596-1650) and Pierre de Fermat, (1601-1655) and on the other by the contributions to the calculus of Isaac Newton (1642-1727) and Gottfried Wilhelm Leibniz (1646-1716). In Euler's century, mathematicians worked on spreading and studying the works of these authors and in perfecting their analytical methods as well as on applying them to solve successfully celestial and terrestrial problems.

Therefore, the aim of this communication is to analyse Euler's contributions in his first stage at the Saint Petersburg Academy of Sciences, considering the three aspects quoted in the symposium: humane, material and over all, intellectual.

Saint Petersburg Academy of Sciences, Leonhard Euler, Analysis

L'exercice du génie militaire au Portugal au temps de Luís Serrão Pimentel: de l'exigence dans l'examen des ingénieurs nationaux et étrangers à l'échange d'expériences à l'étranger

Maria Antónia Marques Fialho Costa Conde, University of Evora

Le point de départ de cet article sera souligner qu'il se trouvait au Portugal, au XVII^{ème} siècle, une remarquable exigence pour la reconnaissance des compétences des ingénieurs, au niveau théorique et pratique, qu'ils étaient nationaux ou qu'ils sont venus de l'étranger. On parlera particulièrement d'une période où cette reconnaissance était faite (par examen) par le Conselho de Guerra, après avoir écouté Luís Serrão Pimentel et d'autres spécialistes, notamment en Mathématique. L'article se centre aussi sur la figure de Luis Serrão Pimentel et de leurs descendants, aussi comme de l'effort fait par ceux-ci pour maintenir la bonne image de Pimentel en tant qu'ingénieur militaire et cosmographe-majeur. Ils ont essayé de mettre à jour leurs discours avec les savoirs de l'Europe à l'époque, et avec leur participation actif aux missions à l'étranger ou dans l'empire portugais, à cause de leur expertise en matière d'ingénierie, fortification et missions de l'armée.

Luís Serrão Pimentel; fortification bastionnée; génie militaire

Trade Relations and the Construction of new companies in the Electrotechnical Sector: Mobility of engineers and knowledge between Portugal and Belgium

Maria da Luz Braga Sampaio, CIDEHUS - Universidade de Évora

Electrification policies and Planos de Fomento (1950-60) in Portugal mobilized investments in strategic sectors such as the production of electrical equipment: motors, transformers, etc.. The relations between the ACEC company and the Portuguese industrial sector are emblematic, analyzing cases such as that of EFACEC, a company that will only assume this denomination after 30 years of cooperation between these two countries. The training of Portuguese engineers and the development of production were dependent on the mobility of both Belgian engineers in Portugal and Portuguese Engineers in Belgium.

Taking advantage of the state support laid down in the energy policies established in the 1940's, the firm E.F.M.E. - Empresa Fabril de Máquinas Eléctricas, S.A.R.L. was founded in 1948, with an important stockholders: ACEC - Ateliers de Constructions Electriques de Charleroi, (enterprise belonging to the Empain group) and quickly became the first national enterprise devoted to the production of electrical engines, allowing the country to receive an important transfer of know-how in the area of electrical equipment and machines. The Belgium enterprise has in Portugal a Director who controls all the

production, and Technological projects and the brothers Ricca Gonçalves, Portuguese members of the board of the company travel often to Belgium to discuss and get permission to new projects. The mobility of the engineer between Belgium and Portugal was essential to develop new brand, a new technique, new types of electrical engines and transformers “made in Portugal”, and presented itself as an actor of a new project in the country's electricity sector.

EFEACEC has a significant share of the national market for the manufacture of series DC motors and medium-voltage circuit breakers.

In the 1960 the emblematic company of the electric sector invested and expanded its factory under the protection of the engineer Ferreira Dias, the Ministry of Economy from 1958 to 1962. The firm consolidated its position in the national market, supplying equipment for several projects, especially for the network of substations then under construction and to hydroelectric plants. (Matos & Sampaio, 2017). By 1970 the EFACEC Company was firmly established in the Portuguese home market.

Mobility; Engineers; Electrotechnical; Belgium; Portugal

International exposure of Francesc Santponç i Roca (1756-1821)

Maria M. Montava-Gadea, Politechnic University of Barcelona (UPC)

This paper is focused in the spread of the know-how processes from the north of Europe to the south. This circulation of knowledge allowed Francesc Santponç, a doctor from Barcelona, to learn how to construct a steam engine using, probably, the newest steam technology that existed at that time. Specifically, we are going to highlight a monthly magazine named *Memorias de Agricultura y Artes*. The aim of the magazine was to spread the knowledge of three areas: Agriculture, Chemistry and Mechanics. In the magazine, published from 1815 to 1821, Santponç was the publisher of the mechanical part. And it is the principal source of knowledge we have about Santponç's international connections.

One of the magazine goals was to gather all the remarkable improvements that had taken place in Europe during the six years of war with France (1808 – 1814). So the magazine itself was a tool for the diffusion of knowledge and know-how processes from the north of Europe to the south.

Thanks to the articles Santponç wrote in the magazine *Memorias de Agricultura y Artes* we know that he was interested in travelers tour reports. In this sort of reports Santponç found a source of foreign technological knowledge.

In the traveler's reports that Santponç selected for his articles, there were description of foreigner technologies but Santponç was also interested in description of human reactions and feelings.

The places that travelers visited were Holland, Meddle East, Asia, Africa, Caucasus and Australia. And the travelers were Mr Letuce, Mr Penon, Mr. Catellan and another one whose name is not mentioned.

The study of Santponç's articles about traveler's reports is not finished. We are searching for the original reports in the Magazines and books that Santponç used to read.

Francesc Santponç i Roca, Memorias de Agricultura y Artes magazine, Circulation of knowledge from the north of Europe to the south, Travellers tour reports

Estrada de Ferro Dom Pedro II: technical aspects of the construction, labor regime, and the political role of engineers as conflict mediators

Mariana Affonso Penna, Museu de Astronomia e Ciências Afins

Gabriel José Rodrigues Dias, MAST

This paper presents some investigations conducted as part of the research "EXPANDING THE IMPERIAL STATE: engineers and the organization of culture in Brazil in the 19th century", headed by Pedro Eduardo Mesquita de Monteiro Marinho, developed at the Coordination of History of Science, in the Museum of Astronomy and Related Sciences (MAST).

As a continuation of the investigations developed by Laura Roberta Fontana, we will focus on the agency of the Engineering Club in the conduction of Companhia Estrada de Ferro Dom Pedro II (Railway Company Dom Pedro II) analyzing their interaction with the Brazilian State during the second half of the 19th century. During this period, there is a significant complexification of civil society and, in the midst of this process, the Engineering Club plays an important role as a spokesperson in the agencies of the political society. Because of that, the implementation of certain routes of communication, its layout and other technical issues that involved the construction of the second stage of the Dom Pedro II Railway, like all other public policy, was the result of conflicts established between fractions of classes with different interests. It is from the understanding of these conflicts, identifying the agency of the engineers that the execution of this public policy becomes intelligible.

Our purpose was to continue the analysis about the organicity of these engineers in the business conduct adopted by the railway company, observing that they gathered capital and worked not only in the planning and in the implementation of the technical projects but also defined the ideological conceptions of the constructions within the Brazilian State.

We also highlight, as part of the recent advances of the research, the collection of a large and unprecedented documentation. These new sources allow us to deepen the reflections already developed by our team. It also permits us to reflect upon new issues not yet addressed by historiography, such as the labor regime implemented during the railway construction, the technical aspects of the execution of the engineering project, the regional disputes and the role of engineers as mediators of the different political and economic interests involved in the execution of the projects.

Engineering; Railway Companies; Labor Regime; State and Civil Society

From "Progress" to "Civilization": the 1861 Brazilian National Exhibition as a preparation of the Brazilian polytechnic for the 1862 London Universal Exhibition

Pedro Marinho, Museu de Astronomia e Ciências Afins - MAST / MCTI

Laura Roberta Fontana, Museu de Astronomia e Ciências afins

The Instituto Politécnico Brasileiro, IPB (Brazilian Polytechnic Institute) was the first Brazilian Association of Civil Engineering. On September 11, 1862, its official foundation took place in a room of the Escola Central do Rio de Janeiro (Central School of Rio de Janeiro), proclaiming the Institute's purpose as "the study and the diffusion of the theoretical and practical knowledge of the different branches of engineering and of the sciences and accessory arts" – according to Article 1 of its Statutes. The year of foundation of the IPB was significant due to the simultaneity of initiatives that indicated the potentialities for the professional agency of the engineers. In 1862, for example, Brazil would participate, for the first time, in a Universal Exhibition held in London. The year before, however, still within the Central School - founded in 1858 - this group has already organized itself in the National Exhibition. It is from the articulations of this group in this period – which precedes and concretizes its first association – that we intend to reflect on the notions of "progress" and "civilization" in Brazil. Likewise,

we will try to show its connections with the constitution of the knowledges and practices of the engineering, as well as the process of formation and qualification of the Brazilian engineers throughout the second half of century XIX. We realize that it is especially at this initial moment – the organization of the engineers in the IPB and their agency in the Central School – that in fact the formation in Civil Engineering in Brazil actually begins (although still articulated to the War Ministry, since its total separation only happens in 1874 with its transformation into Polytechnic School). We will also identify how participation in the London Universal Exhibition, and the preparation for such participation in the National Exhibition, helped in this process of consolidation of Brazilian Civil Engineering.

Exhibitions; Civil Engineering; Brazilian polytechnics

079. Mathematical Methods at Work in Ancient China - Local Applications with Global Connections

The evolution of trigonometry in China: mathematical reasoning from ancient times to the 19th century—an initial investigation

Jiang-Ping Jeff Chen, St. Cloud State University

DONG Jie, Inner Mongolia Normal University, Inner Mongolia, China

Trigonometry in China as a computational basis for mathematical astronomy has always been considered a transplant from the West although China had its own methods to achieve computational purpose in its own theories of astronomy. The introduction of trigonometry played an important role in the process of modernization of Chinese mathematics. This paper examines the reasoning modes in Chinese trigonometric texts from ancient times to the 19th century. Chinese scholars in the early 17th century built on trigonometric knowledge in the translated texts and supplement the reasoning absent in the treatises. Initially the reasoning mode is predominantly geometric. The properties in plane trigonometry were established based on geometric figures while questions in spherical trigonometry were first transformed into those in the plane and then solved with established properties. In the following centuries, as new “algebraic” methods developed in China through the Chinese scholars’ studies and applications of translated European texts, the reasoning in establishing trigonometric properties relied more on the interplay of algebraic methods and geometric diagrams until the translation of a more modern approach to trigonometry arrived in the late 19th century.

Trigonometry, Mathematical Reasoning, Jesuits in China

The Peking University Mathematical Bamboo Document 鲁久次问数于陈起 (Lu Jiuci Asks Chen Qi About Mathematics). Global Significance of Rationales in Ancient Chinese Texts for Doing Mathematics

Joseph W. Dauben, City University of New York

The recently published Beida Mathematical Bamboo Document, 鲁久次问数于陈起 (Lu Jiuci wen shu yu Chen Qi (Lu Jiuci Asks Chen Qi About Mathematics)), presents a dialogue between a master of mathematics, 陈起 Chen Qi, and a student, 鲁久次 Lu Jiuci. This may in fact have been meant as a preface to the substantial amount of mathematical material also found among the Beida bamboo strips acquired by Peking University in 2010. What the dialogue “Lu Jiuci Asks Chen Qi About

Mathematics” raises are some very intriguing questions about the status of mathematics in ancient China and the relationship of the Beida material to other mathematical works that have also only recently come to light, like the bamboo slips also concerning mathematics that were excavated in 1983–1984 at a Western Han Dynasty tomb site near Zhangjiashan in Hubei Province, namely the 算數書 Suan shu shu or Book of Numbers and Computations. Another set of bamboo slips important for comparison’s sake with the Beida slips are those acquired by the Yeulu Academy in 2007, including a mathematical work, simply entitled 數 Shu or Numbers. Direct comparisons with the Lu-Chen dialogue may also be made with the introductions and dialogues to be found in such later texts as the Zhoubi suanjing, the Jiuzhang suanshu, and the Sun Zi suanjing. In these, the student laments his inability to understand numbers and computations and then asks for guidance. What sets the Beida dialogue apart from the others is that the student, Lu Jiuci, admits that he has studied both classical literature and mathematical computation, but cannot thoroughly master them both, and then asks the master Chen Qi which of the two is most important? Chen Qi’s answer, and its implications in the comparative context of ancient mathematics East and West will be the subject of this presentation.

Mathematics, Ancient, China, Peking University, Chen Qi

A tidal Cycle in Ancient China

Qu Anjing, Northwest University
Chen Yiwen, Northwest University

The interpretations of tides are recorded in many literatures in old China. In this talk, such a material in The Haitao Zhi, A Treatise of Ocean Waves of the Tang Dynasty (2nd half of the 8th century) wrote by Dou Shumeng, will be revisited carefully. It is well known that The Haitao Zhi is the first book on tides in ancient China.

According to our analyzing of the related data in the Haitao Zhi, we found that Dou Shumeng did not only figure out the regularity of tides, but also calculated a tidal cycle.

The Haitao Zhi; Dou Shumeng; tidal cycle

A Study of Japanese Mathematical Arts Kept at National Taiwan University and Prof. Heizaemon Kato

Shigeru Jochi, Osaka Kyoiku University (Osaka University of Education)
Bowen Liu, National Kaohsiung First Univ. of Science and Technology

In 2004, 5553 volumes of Chinese books, 2744 volumes of Japanese books and 1256 volumes of Modern Japanese books of Taihoku (Taipei) Imperial University were found at the Hall of the College of Liberal Arts, National Taiwan University. And about 510 books are Wasan (Japanese mathematics and astronomical science) collections. It must be the biggest Wasan collection in the overseas of Japan. It was said that the biggest Wasan collection in America is the Library of Congress. It has 404 books for Wasan, which were the librarian, Honda Shojo (1929-2015) collected.

The collections of National Taiwan University, however, were collected by prof. Kato Heizaemon (1891-1976), former professor of Taihoku Imperial University and Taihoku High School, who is the famous Wasan researcher. Prof. Kato Heizaemon graduated the department of mathematics, Tohoku Imperial University, which is one of the center of Wasan studies in Japan. Therefore Kato Heizaemon already studied Wasan, and collected Wasan books systematically. He bought Wasan books of Seki-

ryu school, then bought books of Saijo-ryu school, that is to say, this collection has quite good quality. Prof. Kato Heizaemon bought Wasan books since 1938, then these books must become the basement of his Wasan studies. Actually he published the Wasan no Hoteishiki-ron in 1943 at Taipei, which is the core of his lifework of Wasan no Kenkyu since 1954. And prof. Kato Heizaemon's first work of Wasan of "Wasan no Gyoretsu-shiki Tenkai nitsukiteno Kento" was already published on the Tohoku Sugaku Zasshi in 1939.

National Taiwan University; Wasan-sho (Japanese Mathematical Arts); Kato Heizaemon

080. Statistique, croissance et développement - Statistic, Growth and Development

People that count. The Imperial Census in the 19th and early 20th Century as a global practice?

Hirschhausen, Ulrike, University of Rostock

Statistics went global since the middle of the 19th century. One of the most visible and most contested manifestations of this statistical trend was the census, which almost all European states and some non-European states as well introduced after 1850 as a key tool of political rule, national integration and economic development. Most of the literature has concentrated on the census as a typical practice of the modern nation state. Yet Europe's multi-ethnic empires also reacted to changing societies, economic challenges and new indigenous populations in their newly conquered colonies by applying the census to both metropole and colony. The proposed paper will analyze the census as an imperial strategy asking for its transfer from Europe in the non-European world, looking at its various outcomes in selected peripheries of Europe, Asia and the middle East and paying specific attention to the very repercussions from the people counted.

Census, Empire, Multethnicity

Ingénieurs, économistes, staticiens: les élites techniques du Minas Gerais et leur rôle pour le progrès, le développement et la planification régionale

Maria do Carmo Andrade Gomes, Fundação João Pinheiro

A l'intérieur de l'État Brésilien du Minas Gerais, les élites techniques et bureaucratiques ont protagonisé, au long de la période républicaine, des politiques de haute performance, soit dans le champ empirique de l'intervention sur la machine administrative et sur le territoire, soit dans le champ symbolique de la construction du discours sur la modernisation, progrès, développement et planification. Deux moments historiques peuvent être signalés comme représentatifs de cette dispute pour un protagonisme capable d'imposer les orientations des politiques publiques, surtout les politiques territoriales.

Au début de la période républicaine, les ingénieurs ont été sacrés comme les acteurs techniques les plus remarquables, ayant des postes auprès du gouvernement régional, dans les tribunes parlementaires, des pages dans la presse régionale, en prônant le progrès et la modernité. Leur force pourrait être mesurée par les initiatives géopolitiques telle que la construction de la nouvelle capitale (Belo Horizonte), le début de la cartographie systématique de l'état, ou encore l'organisation du Premier Congrès Agricole, Industriel et Commercial, en 1903. L'appel symbolique à la vocation

missionnaire et la tradition de la formation polytechnique ont assuré aux ingénieurs un leadership sur les autres acteurs aussi émergents dans les champs professionnels, associés aux politiques territoriales, comme les géographes, cartographes, architectes ou géologues. Mais le grand défi de ces nouveaux acteurs était toujours de se présenter comme option politique aux bacheliers en droit, dominants depuis l'Empire.

A un autre moment de l'histoire républicaine du Minas Gerais, alors aux années soixante et soixante-dix, les ingénieurs seraient enfin remplacés, en tant que formulateurs des politiques territoriales et de planification, maintenant menées et défendues par les économistes. Cette inflexion a eu lieu dans le contexte de renforcement des politiques développementalistes, dont l'outil par excellence sera la planification régionale et urbaine. Les bases scientifiques de ces nouveaux plans formulés ont été construites à partir des supports techniques et des emprunts des expériences extérieures, comme celles du IBGE et de la CEPAL. Et encore fondées sur des analyses statistiques, ont été les économistes, et pas les staticiens professionnels ou académiques, les protagonistes à ce moment-là.

"élites techniques", "staticiens", "histoire de l' statistique"

Knowledge as a public resource: Statistics and economic growth in Central Europe, 1840–1870

Wolfgang Goederle, University of Graz, History Department

Around 1840, in many places throughout Europe statistical data became accessible which had earlier been classified as so important to rulers and states that it had to be kept a secret. This paradigm change has to be placed in a wider context, though the main drive behind loosening the grip on this kind of knowledge was the perspective of economic growth. In the two decades to come, statistical series, journals and magazines flourished all over Europe, but different standards and a myriad of definitions aggravated cross-border data comparison. Soon the International Statistical Congress was founded in order to establish standards and to unify definitions.

In my presentation I would like to focus on the 20 years at the beginning of statistics as an international tool for the measurement of key parameters of societal description and improvement. I will concentrate on Central Europe and show how the Habsburg Empire provided certain statistical knowledge to entrepreneurs and citizens, thus integrating them into state building. In a second step, I will demonstrate how this process developed dynamics of its own, forcing (not only) the Habsburg Empire to make certain concessions it would have liked to prevent in the first place.

History; Statistics; State Building; Central Europe

081. Mathematical Discoveries and Styles of Demonstration across Cultures

Why Did Pre-modern Japanese Mathematicians Fail in Obtaining the Differential and Integral Calculus? The Lack of Rigorous Apodictic Archimedean Proof for Infinitesimal Algebraic Analysis

Chikara Sasaki, Chubu Institute for Advanced Studies, Chubu University

1. Fundamental Characteristics of Pre-Modern Japanese Mathematics, Wasan

Pre-modern Japanese mathematics (wasan), was established by Seki Takakazu (?-1708) and his disciple Takebe Katahiro (1664-1738) in the late 17th century. It was a kind of algebraic analysis,

similar to the symbolic algebra of Viète and Descartes. Seki's later generations, e.g. Takebe, developed a rather sophisticated infinitesimal algebraic analysis ("Enri", i.e. the theory of the circle). But did they succeed in obtaining the differential and integral calculus of Newton and Leibniz? It's true that mathematicians of 18th- and 19th-century Japan attained an algorithmic art of differentiation and an art of integration, very primitive forms of those by Fermat (1607/08-1665); for example, Wada Yasushi (1787-1840). Nevertheless, we have to conclude that they all failed to obtain the differential and integral calculus. Why?

2. Absence of Rigorous Apodictic Geometrical Synthetic Proof for Infinitesimal Analysis in Wasan
 Karen Chemla ("Prologue," in ead., ed., "The History of Mathematical Proof in Ancient Traditions," 2012), insists that there were certain notions of proof in traditional Chinese mathematics, following her Chinese colleague Guo Shu Chun's understanding on Liu Hui. Her proposal can be ascertained to some extent, but the concept of mathematical proof is not simple nor monolithic and should be differentiated by introducing the concept of modality. Chinese and Japanese mathematics had intuitive demonstrations for right-angled triangles and a kind of algebraic analysis for algorithmic calculations. However, there existed no rigorous apodictic synthetic proof for Enri, of the type seen in Archimedes' Quadrature of the Parabola. By applying this kind of synthetic proof to infinitesimal geometry, Torricelli, Gregory, Barrow, Newton, and Leibniz would demonstrate the geometrical forms of the fundamental theorem of the differential and integral calculus, and only the latter two attained its algebraically analytic formulation.

We can conclude that pre-modern Japanese mathematicians developed certain algorithmic arts of differentiation and of integration, but could not get neither the fundamental theorem of the differential and integral calculus nor the system of calculus, because of their lack of rigorous geometrical proof in its Archimedean form. This applies as well to all of East Asian mathematics.

Wasan; Differential and Integral Calculus; Wada Yasushi; Apodictic Archimedean Proof

Proof-Events as Fundamental Methodological Concept in History of Mathematics

Ioannis M. Vandoulakis, The Hellenic Open University

Historians of mathematics essentially study proof-events in their research, since the mathematical proofs they face in the extant sources involve many informal components, often not completely formalizable, and convey some kind of semantic content calling for understanding and verification. The concept of proof-event that was introduced by Joseph Goguen, can serve as fundamental methodological tool for studying proofs in history of mathematics. In this framework, proof is understood not as a purely syntactic object, but as a social process that involves at least two agents: a prover and an interpreter; this highlights the communicational aspect of proving. Proof events generate proofs presented in different styles which characterize different cultures, schools or scholars that may differ in views of meta-theoretical character.

We illustrate the application of this methodological approach in some outstanding historical cases, paying particular attention to the process of proof interpretation that makes a proof-event alive.

mathematical proof; proof-events; provers vs. interpreters; communicational aspects of proof-events; styles of proof

Two elegant derivations of the Surface Area of a Sphere by Bhāskarācārya

K Mahesh, IIT Bombay

The problem of ascertaining the surface area of a sphere is a fairly complex problem which seems to have tested the limits of the ingenuity of the ancient mathematicians. In the Indian tradition, the first correct solution to this problem is found in the *Mahāsiddhānta* of Āryabhaṭa II (c. 950 CE). Subsequently, Bhāskarācārya (12th century CE) also presented the exact expression along with two brilliant demonstrations of it in his famous work *Siddhāntaśiromaṇi*. In the Greek tradition, Archimedes (c. 287–212 BCE) is attributed with the solution to this problem in his work 'On the Sphere and Cylinder' along with a proof of it. The genesis of Archimedes' approach lies in the Greek propensity to 'exhaust' curvilinear figures or objects through appropriate rectilinear counterparts and the use of double 'reductio ad absurdum' argument. In contrast, Bhāskara instead of trying to fit in the curvilinear shape with a rectilinear figure, proposes two methods to dissect the surface of the sphere into measurable rectilinear units: one by means of trapezia, and the other by conceiving it to be made up of several lunes. Then he simply sums up the elementary areas to get the required result. It is to be noted that Bhāskara's ingenious approaches have some elegance and pedagogical importance.

Bhāskara, Surface Area, Sphere

Renaissance Discussions on Mathematical Demonstrations: Aristotelians and Humanists

Shin Higashi, Center for Liberal Arts, Tokai University

The objective of my presentation is to shed new light on how mathematical demonstrations were regarded in the late Renaissance, especially in connection with the intellectual and philosophical background in which such discussions evolved.

Discussions and debates among the philosophers and mathematicians from the period is evidence of how mathematics as a science attracted scholarly attention coming from a variety of concerns, from philosophical interest to practical or pedagogical concerns. Historical studies have shown that, during the century preceding the development of the new mathematics and mathematical physics of Galileo, Descartes and Newton, mathematics was the object of renewed interest in a variety of circles, from university scholars to humanist editors to artisans and practitioners of the techniques. One outcome of this rising interest was the debate on the epistemological status of mathematical demonstrations, sometimes called the debate on the certainty of mathematics (*certitudo mathematicarum*).

However, the historical significance of Renaissance philosophy of mathematics cannot be assessed adequately without an understanding of the philosophical and historical context which shaped these discussions. Aristotelianism and Humanism are two such factors. Contrary to what the name may suggest, the debate on the certitude of mathematics was not about whether mathematical knowledge was certain or not, but rather about how to explain the persuasive power of geometrical and arithmetical demonstrations. Thus, philosophers examined whether mathematical demonstrations satisfied the norms of scientificity postulated in Aristotelian theory of science, which resulted in different views of mathematical demonstrations.

In my presentation, we will look at the different ways of conceiving mathematical demonstrations in the sixteenth century. At the same time, we will think about the factors which made such discussions possible at that particular historical conjuncture. Factors such as ancient and medieval antecedents to the Renaissance debates; basic tenets of Aristotelian and Averroist epistemology and philosophy of mathematics; Platonic and Neoplatonic philosophies of mathematics; and finally, humanist theories of science since Petrarch will be important.

082. Global Mathematics

A Language of its Own? Communicating Mathematics across Language Barriers

Christopher Hollings, University of Oxford

During the years of the Cold War, Western mathematicians developed a great interest in Soviet mathematics, which they perceived as world-leading, and therefore engaged in many efforts to gain greater access to the relevant work. On the language side, these ranged from the teaching of courses in mathematical Russian to the cover-to-cover translation of major Soviet journals. Indeed, where Western resources for accessing Russian-language materials were concerned, mathematics was one of the best-served disciplines. I believe that this enthusiasm was due, at least in part, to the nature of mathematical Russian: that a knowledge of mathematics enables the reader to glean some small amount of understanding, even if they know no Russian. In this talk, I will extend this suggestion to other languages, and argue that the near-universal nature of mathematical notation, terminology and writing style (certainly in recent centuries) has given mathematics a privileged position in the communication of scientific ideas across language barriers.

language; Cold War; mathematical Russian; mathematical language

L'American Mathematical Society comme actrice de la promotion des géométries étatsuniennes sur la scène internationale

Duran Samson, Université Paris-Sud

Dans les premières années suivant la création de l'American Mathematical Society, en 1888, la rhétorique des mathématicien-ne-s étatsunien-ne-s les place comme étant d'un niveau mathématique en deçà de ceux des grands pays que représente l'Allemagne ou la France. Par ailleurs, des études historiques sur la formation des doctorant-e-s à l'étranger et le développement des institutions sur le sol étatsunien ont montré la constitution d'une communauté de recherche en mathématique solide dans le pays, lors du dernier quart du 19e siècle.

La situation étatsunienne va continuer à évoluer lors des vingt premières années du 20e siècle. Pourtant l'historiographie n'a pas proposé d'études sur les géométries dans ce pays pour ces deux décennies, et les constats passent donc souvent d'une communauté en formation sur la fin du 19e siècle à des travaux géométriques bien connus et influents à partir des années 20. Une étude des travaux géométriques portés par l'AMS montrera que ce moment constitue pourtant justement celui d'une évolution pour passer du discours d'une nation élève du modèle allemand à celui d'une grande nation mathématique sur la scène nationale, et dont le niveau en recherche mathématique n'a plus rien à envier à celui des autres grandes nations européennes.

Mon étude s'appuiera sur l'étude d'un ensemble de marqueurs variés apportant différents éclairages sur l'évolution des travaux liés à la Géométrie aux États-Unis d'Amérique. J'aborderai ainsi la question du regard porté sur la scène internationale par la société, via les recensions de géométries dans le Bulletin de l'AMS, mais aussi dans les rencontres organisées par la société. De plus nous verrons que la création d'un journal dont les articles sont destinés à s'insérer dans la recherche internationale en portant haut les positions étatsuniennes sur la géométrie et l'évolution des enseignements universitaires dans le pays montre les volontés d'un développement fort qui est là

aussi porté par la société.

J'essaierai ainsi de montrer comment les acteur·rice·s de l'AMS ont cherché à placer leur pays comme une nation importante en Géométrie sur la scène nationale lors des deux premières décennies du 20^e siècle.

History Geometries American Mathematical Society

Backwards Graphs: Negotiating the Local and the Global at the Nesin Mathematics Village

Ellen Abrams, Cornell University

Recent findings in Leavitt path algebras and graph C^* -algebras have brought mathematicians together to explore a “mysterious” connection between the two fields. Researchers interested in either field, however, practice distinct forms of mathematics: Leavitt path algebras are primarily studied as a specialty in algebra, whereas graph C^* -algebras are a topic of analysis. In general, algebraists and analysts belong to distinct communities that differ in terms of norms, conventions, styles, and approaches. Yet in June-July 2015, representatives of both groups from ten different countries across five continents came together for a joint CIMPA (Centre International de Mathématiques Pures et Appliquées) Research School held at the Nesin Mathematics Village near Şirince, Turkey. While Science Studies scholars have characterized the coordination of diverse communities in terms of “trading zones,” the coordination between algebraists and analysts at the Nesin Mathematics Village was directed instead toward the cultivation of a trading community. For the duration of the Research School, representatives of both groups took turns presenting to an audience of graduate students in a way that suggests a process of “training for trade.” This process of training highlights the multi-sited production of mathematics between the imagined globalism of formal publications and the grounded production of knowledge at local institutions.

trading zone; Nesin Mathematics Village; algebra; analysis

On the universalization of linear algebra: the emergence of a global discipline from local mathematical cultures (1900-1960)

Frédéric Brechenmacher, LinX, École Polytechnique

The emergence of linear algebra as an international discipline highlights a complex phenomenon of globalization of a specific organization of knowledge aiming at universality, both in mathematical research and education. Although this phenomenon took place within a decade, in the 1930s, it involves the long-term interrelations of various local mathematical cultures, involving specific practices, forms of representations, values, and ideals.

This phenomenon challenges not only the usual description of the history of algebra as a progress toward more and more abstraction, but also the importance that has usually been given to a few specific mathematical theories, individuals, and social environments. For instance, while the historiography of algebra has tended to lay the emphasis on German developments in algebraic number theory, the universalization of matrix decomposition highlights the key role played by circulations of specific practices within a network of texts involving mostly French and American mathematicians. Investigating such circulations between the local and the global raises the issue of the relevant categories for describing collective organizations of knowledge or the social identities of groups of actors.

The role of foreign languages in the institutionalization of mathematics as a science in Japan during its buildup phase 1870-1930 – practices in the university instruction and the publication market –

Harald-Michael Kümmerle, Martin Luther University Halle-Wittenberg

The Meiji government which came to power in 1868 early after started to build the first compulsory formal education system in the history of Japan. The import of Western technology and – as its foundation – Western science was given a very high priority in the government's policy in order to avoid colonization by the Western powers. While the founding of Tōkyō University in 1877 is often given as an epoch-making date in the history of Japanese higher education, overemphasizing this shadows that there were much more continuities than discontinuities. Although most of the foreign teachers at the Faculty of Science were replaced by Japanese ones in the next decade, lecture notes in mathematics and natural sciences were taken in foreign languages (mostly English) for decades to come regardless of the possibility to communicate in Japanese colloquially. While this can be considered a natural example of institutional inertia, examining the reasons which contributed to this choice gives much insight into import strategies of scientific knowledge.

Likewise, the language of research published by the university staff did not change to Japanese once the teaching staff had become Japanese. While this is connected to the preference of foreign languages in class, there were also political reasons: the journals were by and large funded by the government, for which having research institutions gain a good reputation abroad was an issue of national prestige. Correspondingly, the fact that for people without a connection to academia it was difficult to publish in Japanese Western-language journals guaranteed a minimum standard for research by Japanese that was recognized internationally.

At the junction of academic teaching and academic research, textbooks can fill an important gap by giving comprehensive and streamlined presentations of single topics. But in respect to the publishing of textbooks, economic calculations played a much bigger role than practical considerations in class or political priorities for obtaining a high reputation. Because the field of mathematics had rather low enrollment numbers for a long time, it was not until the 1920ies that Japanese language textbooks began to appear.

Japan; mathematics; university; language; journal

Examples of “géométrie de situation” in the second half of the nineteenth century : between local practices et global circulations

Jenny Boucard, Centre François Viète, Université de Nantes

During the XIXth century, the expression « Géométrie de situation » is linked to very different mathematical practices even if it refers initially to some geometry focusing on situation or qualitative rather than quantitative properties. Here I focus especially on two main authors - Louis Poinot and Edouard Lucas - who promote a « Géométrie de situation » linked with number theory and mathematical recreations. In 1810, “géométrie de situation” is defined by Louis Poinot as a geometry where one "sees less the magnitude and proportion of the figures, than the order and location of the various elements that compose it." Poinot also indicates some important figures in the development of it, including Leibniz, Euler and Vandermonde and his work is then devoted to polygons and polyhedra. In 1891, a chapter of Edouard Lucas' *Théorie des nombres* is entitled

ICHST
2017

“géométrie de situation”. It comprises a set of problems including chess, polygons, polyhedra or lattices. For both authors, the “géométrie de situation” is a domain linking number theory, geometry and combinatorics. In this paper, I analyze the circulation of problems associated with the “géométrie de situation” and linked with polyhedra and chess boards by focusing on the media the different authors used to spread their work and how they were received in local, national and international scales. I show that these problems can be integrated in various disciplinary configurations according to different times and institutional spaces and I study the local and global aspects involved in terms of goals, values, practices, institutions.

géométrie de situation; mathematical recreations; number theory; combinatorics; circulation of knowledge

Mathematics, National Culture and Class in 1930s Japan and China

Jiri Hudecek, Charles University

China entered global mathematical mainstream after 1905, when new schools started teaching Western curricula and Chinese students went abroad to receive advanced education. By the mid-1930s, a dynamic mathematical community had been established with ties to research centers all over the world. At the same time, traditional Chinese mathematics was being studied by first-generation historians of mathematics such as Li Yan (1892-1963) and Qian Baocong (1892-1974) as a revealing probe into the Chinese culture. These historians were motivated in their effort by developments in the history of mathematics abroad, especially in Japan. The Japanese historian Yoshio Mikami (1875-1950) understood mathematics as a particular offshoot of a holistic national culture, constructed from the culture of the Edo-period samurais. His Chinese counterparts argued that achievements of premodern Chinese mathematics meant that Chinese culture as a whole had a potential to embrace science and modernity.

Cultural nationalism was challenged by Marxists. Japanese historian Kinnosuke Ogura (1885-1962), influenced by G. Plekhanov, developed a class analysis of mathematics to reject cultural essentialism. Many of his articles were translated into Chinese, including a detailed criticism of Ludwig Bieberbach's (1886-1982) racist classification of mathematicians used to promote his ideas about "German mathematics". This article also warned against Japanese "Bieberbachs" and attempts to define a racially pure Japanese mathematics. In this paper, I will show that the interest Ogura's articles generated in China was not a reflection of Chinese mathematicians' belief in the universalism of mathematics, but rather of the power of Marxist social theories and the utility of Ogura's arguments in the struggle against cultural imperialism.

mathematics and national character; Kinnosuke Ogura; Ludwig Bieberbach; Marxist history of mathematics

Reaching beyond National Boundaries: American Mathematicians Abroad in the 1920s

Karen Hunger Parshall, University of Virginia

The revival of the International Congresses of Mathematicians (ICMs) in the 1920s reflected a partial resumption of international mathematical contacts in the aftermath of World War I, but mathematicians in the United States wanted more. They had a sense of destiny. They saw it playing out at home with the success of their efforts to strengthen the infrastructure for their mathematical

endeavors, but they also aspired to see it play out much more broadly. American Mathematical Society Secretary (AMS), Roland Richardson fully captured that spirit in a 1924 letter to Princeton geometer and then AMS President, Oswald Veblen. "America has in the past quarter-century made great strides in both pure and applied science," he stated, "and it is hoped that by this move ... new forces will be let loose which will contribute toward putting America in the front rank which should be hers." The "front" of that "rank" was clearly measured by an international yardstick. One way to begin to achieve that broader recognition was for American mathematicians personally to represent their maturing community---as well as directly to share the fruits of their mathematical labors---abroad. Algebraist Leonard Dickson and others had done exactly that at the Strasbourg and Toronto ICMs in 1920 and 1924, respectively. The Americans, however, capitalized on other opportunities over the course of the 1920s in Europe as well as in Latin America. This talk will explore some of those contexts as it analyzes some of the nationalistic motivations that drove early efforts toward the globalization of mathematics.

history of American mathematics, globalization of mathematics, twentieth-century mathematics

Show you're working: Exploring visibility, productivity and competition in mathematics institutes

Lorenzo Lane, University of Edinburgh

I relate the local practices involved in producing mathematics in mathematics research institutes to the global field of discourse within which such practices are valued and oriented. Using ethnographic observations, interviews, and textual materials collected over 6 months of ethnographic fieldwork at 4 leading European mathematics research institutes, I study how knowledge and identity are presented, produced and performed within different social settings. I show how knowledge is transformed as it moves from private, informal settings to public, formal stages of presentation, demonstrating how the processes of "working-out", "writing up" and "writing out" serve to select, sort, and sanitise knowledge, so that it conforms to certain aesthetic criteria. These different presentations of knowledge and self, I explain, are influenced by the wider field of discourse within which mathematicians are situated. Using Bourdieu's (1980) notion of field, habitus and practice, as well as Goffman's (1959) work on theatres of performance, I describe the social mechanisms by which productivity, visibility and competitiveness relate public discourse to private practice, and allow us to understand how the idea of a "global" mathematics can be realised on multiple local scales.

Bourdieu, Habitus, Goffman, Performance, Ethnography

Italian culture and the education of Brazilian mathematicians and physicists: the books adopted by University of São Paulo

Luciana Vieira Souza da Silva, University of São Paulo

This talk explores the circulation of Italian text-books at the University of São Paulo, Brazil, in the 30s. During the Italian Fascist Government of Benito Mussolini, several cultural products were sent to foreign countries, such as movies, photographs, books, and even teachers and intellectuals, in order to diffuse Italian culture and spread positive propaganda of the Fascist Government. In the year 1934, attending these cultural policies, a group of Italian teachers known as Italian Mission was invited to teach at the Faculty of Philosophy, Sciences and Letters of the University of São Paulo, in Brazil. The point of this talk is to explore the diffusion of Italian culture in Mathematics and Physics

ICHST
2017

courses during the classes of Luigi Fantappiè and Gleb Wataghin. In a history of books perspective, according Robert Darnton and Roger Chartier studies, books and text-books are significant vehicles to diffuse a culture (specially a dominant culture), thanks to their writing, production, and circulation. In this sense, we will analyze the lists of physics' and mathematics' Italian books bought to the Departments of Mathematics and Physics in the 1930 decade, as well as the text-book written by Gleb Wataghin in 1934 November, focused on his Brazilian students, in order to bring to light the authors, the publishers and the buyers of these books. In preliminary analyses, we observe authors such as Tullio Levi-Civita, Guido Castelnuovo and Francesco Severi, and different publishers, such as Vallecchi, Zanichelli and Società Italiana di Fisica. This study is supported by the grant 2015/20490-8, from the São Paulo Research Foundation (FAPESP).

Italian culture; University of São Paulo; Text-books; Mathematics; Physics

Problems and Prospects in the History and Historiography of Global Mathematics

Michael J. Barany, Dartmouth College

My talk will offer a thematic survey to guide discussions within the "Global Mathematics" symposium, with a focus on the historical and historiographical questions that arise in studying global mathematics, as distinct from other areas of global history or the history of mathematics. In addition to material from the current historical literature, I will use findings from my own research on the history of the theory of distributions and the 1950 International Congress of Mathematicians to raise and complicate different points of the historiography. Developing the perspective articulated in the symposium description, I will define global mathematics and indicate some guideposts to its geography and periodization. Among a range of relevant historiographies, I will position global mathematics with respect to recent scholarship on international, transnational, and global technoscience, as well as on the transmission, communication, and institutionalization of mathematics. I will identify several themes—including scale, translation, materiality, and knowledge-politics—that have been well studied under other rubrics but demand renewed attention in view of the particular contexts and dynamics of global mathematics. These give rise to a number of methodological challenges for historians of global mathematics, as well as a number of vital avenues for research and collaboration.

Mathematics; Globalisation; Historiography

The “Schrödinger Postdoc”: Work and careers of mathematicians in the global neoliberal academy

Milena Kremakova, International Research Center re:work (Work and Human Life Cycle in Global History), Humboldt-University Berlin

PhD in mathematics: what next? This paper will discuss what pathways postdoc mathematicians take on today's global scientific job market, how their personal and professional biographies unfold in parallel, and what the challenges of combining a career in mathematics with personal life. I call today's typical PhD-graduate the “Schrödinger postdoc”: an aspiring scientist whose career is a patchwork of short-term, insecure postdoctoral positions, often across institutions and countries.

Work and careers in science are framed by profound transformations in the structure and role of the contemporary university. These have often been described as a move away from the traditional Humboldtian “knowledge community” and towards a neoliberal “academic capitalism”. As universities becomes more like firms, jobs in higher education and research are ever more precarious.

Governments increasingly favour applied sciences at the expense of theoretical fields. Academic work and academic careers both increasingly international, but also pervaded by global inequalities. The organisation of teaching and research is increasingly fast-paced, bureaucratic and dependent on performance metrics. The number of academic fields and publications growing faster than ever. The “technocratic” time of the university clashes with the “thinking time” requires to do good science. The internationalisation of science, precarious jobs, and the acceleration and marketisation of academic life create the conditions in which the working lives of men and women mathematicians unfold. They also shape science itself, by influencing which problems are tackled, how teaching is organized, how collaborations are structured, and how universities are run.

While academia, science careers and knowledge labour have been attracting more attention by sociologists and anthropologists of work, mathematics has largely evaded scrutiny. Aiming to fill some of this gap, the paper presents findings from a new three-year ethnographic study of work, labour and careers in the mathematical sciences. The research included ethnographic participant observation in mathematics departments, a comparison of the UK and German academic systems in a global context, and 105 life-course interviews with men and women mathematicians at all career stages, mathematicians no longer in academia, and university administrators.

academic marketization; higher education; life course; mathematics; precarious careers

Between national traditions and international debates: French mathematics teaching in search of modernization in the 1950s and 1960s

Radtko Catherine, CNES/ISCC

After the World War II, many countries reformed mathematics education in relationships to the “New Math” movement. In France, new approaches and contents found their way to textbooks and classrooms in the late 1950s, and the reform culminated in the 1960s. Changes in the curriculum were linked to the changing professional practices of mathematicians, to a renewed social role of mathematics and mathematicians, and to changing values and aims of education. Many of these aspects and their consequences on mathematics education were discussed in international meetings organized with the help of the OEEC (later OECD), the UNESCO, the ICMI or the International Commission for the Study and Improvement of Mathematics Teaching. French mathematicians and mathematics teachers actively participated to the movement, while on the national scene the French association of mathematics teacher (APMEP) strongly advocated the modernization of mathematics teaching in a way which, progressively, put forward the implementation of “new math” curricula. The paper will come back to the debates regarding mathematics teaching in France during the 1950s and the 1960s, and link them to discussions held in international bodies. The purpose will be to investigate the international influence with regards to French specificities and to consider their possible survival after the reform. In particular, I will argue that, even though the actual experience of teaching new math in schools might have been relatively short, this reform changed for long the image of mathematics, not only because it resulted in the implementation of an axiomatic and structural conception of Mathematics which remains presents in the collective memory, but also because it unraveled the cultures and infrastructures of mathematics education. By comparing the situation of mathematics teaching in France and in England after the World War II, I will show that the “New Math” reform fostered the disappearance of a culture proper to the primary order of education and of entire branches of mathematics, such as cosmography, which characterized French mathematics teaching up to the late 1950s. Together with contemporary structural changes that affected the entire educational system, the “new math” movement would then be seen as a driving force towards globalization during decades marked by competing traditions and opposed understandings of the relationships between mathematics and pupils.

education; new math; France; primary and secondary orders

The Librarie Scientifique Albert Blanchard and the international market of scientific books

Rogério Monteiro, University of São Paulo

The circulation of students, mathematicians, books and journals was a fundamental element in the homogenization process that mathematics underwent in the 20th century. From a local point of view, the development of national communities of professional mathematicians depended on the economic capacity of local elites to send their students to study abroad, but also on the capacity of these communities to keep up to date with the new theories and methods developed in others centers of research. In this respect, a preexisting book market with librarians and editors capable of offering imported materials was an essential and precondition for the process of homogenization. Far from assuming a diffusionist perspective, these agents from the world of books translated and edited foreign authors, imported volumes, and sent their catalogs abroad, assuming a cosmopolitan strategy in order to reach their customers. In this context, the role of publishing houses in the circulation of mathematical sciences should not be disregarded. The editorial strategies of the Librarie Albert Blanchard richly illustrate this issue. Located near the Sorbonne, in Paris, the library was well known as a bookseller for the exact sciences and an editor of occasional brochures and doctoral theses, taking advantage of the Sorbonne's large student population. In addition, Albert Blanchard specialized in publishing foreign books in mathematics and physics, both in their original languages and in French translation.

Analyzing his long list of publications, it seems that the editor assembled his catalog by mixing translations of a few known figures like Sommerfeld, Herman Weyl, Ricci and Levi-Civita with works by unknown, young scholars and outsiders of the French community of mathematicians. His commercial formula offered a perfect occasion for foreign engineers and mathematicians to publish original works in France, thereby achieving some international visibility. Their ranks included the Swiss Gustave Juvet, from the University of Neuchatel, the Brazilian engineer Theodoro Ramos, from the Polytechnic School of São Paulo, and the French naturalized Belgian François Bouny, professor at the Technical Faculty of Hanover.

In my communication, I will explore the long list of authors edited by the publishing house Librarie Albert Blanchard, connecting his dual editorial strategy with the problem of the emergence of an international network of mathematicians.

History of scientific edition; Albert Blanchard; international circulation of books; history of mathematics

An Unlikely Collaboration: The Geopolitical Context of Pascual Jordan's Eponymous Algebra

Ryan W. Dahn, University of Chicago

Historians have rightfully identified the Nazi takeover of Germany in 1933 as a turning point in global scientific history. With the near-instantaneous dismissal of Jewish and left-leaning scholars that same year, German science lost many of its brightest lights; the ensuing wave of emigration dispersed this formerly-local community across the world. Meanwhile, those who remained in the Nazi state became increasingly isolated from their colleagues abroad in the face of official suspicion of foreign contacts and resulting restrictions on international travel.

Against that backdrop, this paper presents the story of a highly unlikely mathematical collaboration that managed to bridge that divide. In late 1932, physicist Pascual Jordan stumbled onto the idea

that non-associative algebras might be the path forward for quantum electrodynamics, just as non-commutative algebras—in the form of matrix multiplication—had been the key to understanding the quantum revolution of the 1920s. During early 1933, this interest developed into an intense collaboration with John von Neumann and Eugene Wigner, culminating in a famous ‘three-man paper’ that outlined what are now termed ‘Jordan algebras’.

This collaboration would not be surprising under normal circumstances, as the three had long been friendly. Yet under the political conditions it is exceptional: as the paper was being written in spring 1933, Wigner and Neumann fell victim to the Nazi purge of Jewish scholars and made plans to permanently emigrate to the United States. At the same time, Jordan was professing his allegiance to the new regime in a series of articles under his political pseudonym; he ultimately joined the Nazi Party on May 1. Amazingly, these events had no impact on the collaborative spirit of the three, and Jordan eagerly agreed to the suggestion of Wigner and Neumann that the article—drafted and conceived in German—be published in English, in the American journal "Annals of Mathematics". The ultimate appearance of the three-man-paper in 1934 cemented a friendship that managed to survive the war years; the present paper examines this unlikely collaboration as a microcosm of global mathematics in the 20th century.

history of mathematics; Germany; scientific internationalism; Pascual Jordan; John von Neumann

Let the wise children win - Mathematics Education in the Cold War era

Snezana Lawrence, Anglia Ruskin University

The emergent practices, skills in learning and teaching mathematics, and the network structure of the international mathematics competitions for pre-university students grew into a knowledge community which gives a particularly interesting picture of the mathematics education of the Cold War era. The usual rivalry from the period between the East and the West, in this case had seeds in the competitions introduced first in the USSR but which grew into international and then a global phenomena of the mathematics education.

This talk will test implicit systems of values and images of mathematics and mathematics education that have been projected from this system of competitions. It will pose questions about acceptance of such views and values on a global level, via mapping development of mathematics knowledge in national clusters and the communities formed within this global framework.

Cold War, Mathematics Olympiads, mathematics education

The impact of mathematics on a global scale

Ursula Martin, University of Oxford

Our social policy approach complements historical analysis to understand how, as countries around the world increasingly ask a return on research investment, universities use impact to demonstrate global influence. In the US and Europe, the traditional view of mathematics as an intellectual endeavour pursued for its own sake, has been increasingly challenged by an instrumental view. Vannevar Bush's forceful argument for funding science - that unfettered intellectual curiosity gives rise to unpredictable and useful discoveries - endures in present day advocacy for mathematics funding.

A 2010 UK government study by Deloitte used a top-down methodology to argue that mathematics research underpins 10 % of all UK jobs and 16 % of UK GVA. The availability of 209 standardised case studies of the impact of mathematics, collected across 52 universities as part of the UK's 2014

research assessment, allowed us to conduct a bottom-up multi-method study of how research in mathematics gives rise to impact. We used a categorisation developed for social science research, classifying impacts as Instrumental, Conceptual, Capacity-building, Culture Change and Enduring Connectivity. This variety of impact types, going beyond more usual patents or start-up companies, was found to fit the impact of mathematics, in particular to capture impacts on policy, and thus to capture more completely the global impact of UK mathematics research.

The study also identified significant impact mechanisms, in particular long term relationships, interdisciplinarity, and impact via other academic disciplines. Though often not explicitly recognised, a variety of knowledge intermediaries, bridging the gap between researchers and users, are important: skilled individuals, readily available software, and specialist networks, for example through learned societies. The increasing globalisation of research through exchange of people and ideas, enabled by the internet, increases the reach of impacts.

Mathematicians often favour rigid linear narratives of intellectual influence, while also arguing that requirements to produce such linear narratives distort the reporting of impacts. Drilling into research themes finds complex international ecosystems of impact: papers, people, research users, knowledge intermediaries, with enduring links and fluid boundaries. Ironically, the more complex the ecosystem, the easier it is to extract such linear narratives: but the less representative they seem to be.

mathematics; impact; social policy

083. Transmathematics and the Philosophy of Numbers

Semiotics of Mathematics: Understanding how symbolism can change our perception of an object

Dorival Rordrigues da Rocha Junior, Universidade Federal do Rio de Janeiro

Mathematical language is a powerful set of symbols ruled by logic. It is used as a credibility certificate in the sciences and extends to common sense. Doing mathematics is a mental process, yet mathematicians manipulate a semiotic system of symbols to do their work. The mental activity deals with abstract entities, manipulated according to a logical structure. When these entities are described on paper, one might wonder how veridical the description is to the abstract object or how the script might affect that object.

Symbolism is normally seen as an abstract doing; however, Tall (A Versatile Theory of Visualisation and Symbolisation in Mathematics, 1994) says as symbols are written and seen, they are more than mental reflection. Marks on paper allow deeper thoughts on symbols, bringing up others perceptions over the object. Manipulation of symbols is connected to the way one does mathematics. Some processes, expressed in symbols, can turn into objects, to be manipulated; what Tall calls procept, when expressions represent either a process or a concept.

Rotman (Toward a Semiotics of Mathematics, 2000) tries to reconcile written symbols and abstract ideas. He states that a finite, human Subject takes the marks on paper, the mathematical symbols, transports them to an imaginary mental world, containing an Agent, where finite and infinite mathematics are possible, and then a mental projection of the Subject into the Agent process this information. Some manipulations are finite and can be done by the Subject alone but only the Agent can access the idea of tending to a limit, for example; although the Subject may divide one by a number, only the Agent can truly perceive the infinitary activity the concept of limit holds. Given Rotman's structure, an individual reading mathematical text creates this Agent to perform the actions and then the Subject registers it. According to Rotman what validates mathematical work is the Person, an entity with time and cultural background that combines the Subject and Agent. Transmathematics claims that signs are potential activity of a mathematical Subject. Its semiotic representation gives arise to new kinds of perceptions for old concepts, such as $x + 1$, or infinity, what was once seen as a process gets objectified. One might have wondered what 0 over 0 means,

that can be a completely different thought when a Person visualizes a point floating over a line. These representations change perception on known objects.

Semiotic; Symbolism; Transmathematics

Naive Set-Theory Without Paradox!

James Anderson, University of Reading

Sets and numbers influenced each other in the history of mathematics. We now show how set theory can respond to the transreal numbers.

We adopt first-order logic, with equality, $=$, as a base language. In modern terms naïve set-theory takes $\{x \mid \phi(x)\}$ to be a set, defined by the class $\phi(x)$. The Russell Paradox shows this is inconsistent. Historically this inconsistency was barred by type theories or syntactic restrictions on sets. No such barring is necessary!

We adopt naïve set-theory, as a class theory, with a Universal Class, U , partitioned into the Universal Set, V , and the Universal Antinomy, W , such that $x \in V \Leftrightarrow x = x$ and $x \in W \Leftrightarrow x \neq x$. We assert an equivalence operator, interchangeability, \equiv , whose base case is that two objects, in our class theory, are interchangeable if their defining sentences, in the base language, are identical. We define a special set, infinity, $\infty = V \setminus \{V\}$ and a special antinomy, nullity, $\Phi \equiv W \setminus \{W\}$. The usual constructions of the natural and ordinal numbers now construct transnatural and transordinal numbers and none of the usual paradoxes of set theory hold. As an example we dissolve the Russell Paradox.

$Rw \equiv \{x_1 \mid x_2 \notin x_3\}$ is the Russell Antinomy, when $x_1 \equiv x_2 \equiv x_3$. Suppose $x_1 \equiv Rw$, then $Rw \in Rw$, whence $Rw \notin Rw$, by $x_2 \notin x_3$. Thus $Rw \in Rw \Rightarrow Rw \notin Rw$. Conversely suppose $x_2 \equiv x_3 \equiv Rw$, then $Rw \notin Rw$, whence $Rw \in Rw$, by x_1 . Thus $Rw \notin Rw \Rightarrow Rw \in Rw$. Combining implications we have the classical paradox: $Rw \in Rw \Leftrightarrow Rw \notin Rw$.

The Axiom of Extensionality states: $x = y \Rightarrow (z \in x \Rightarrow z \in y)$. Taking $x = y = z = Rw$, gives $Rw = Rw \Rightarrow (Rw \in Rw \Rightarrow Rw \in Rw)$ but we have $Rw \in Rw \Leftrightarrow Rw \notin Rw$. Therefore $Rw \neq Rw$, so Rw is an antinomy. How do we dissolve Russell's Paradox? We cannot assert Rw does not exist, because it exists as an antinomy. We cannot assert one of $Rw \in Rw$ or else $Rw \notin Rw$ because, in either case, the paradox would be a contradiction. The Axiom of the Excluded Middle blocks the dialetheia: $Rw \in Rw \ \& \ Rw \notin Rw$. What remains? A gap remains: $Rw \in Rw$ has no degree of truth or falsehood.

We define that $Rv = Rw \cap V$ is the Russell Set. Some easy, non-paradoxical theorems follow, including: $Rw \notin Rv$; $Rv \notin Rw$; $Rv \in Rw$!

Transreal numbers, Russell's Paradox, set theory

A look at the dynamics of science construction through transreal numbers

Isabel Cafezeiro, Universidade Federal Fluminense

André Campos da Rocha, HCTE - UFRJ

Carmem Gadelha, HCTE - UFRJ

Ricardo Kubrusly, HCTE - UFRJ

We realize that certain subjects (or approaches) of science occupy a place of clear disadvantage as if they were a demerited science. At the same time, another set of themes receives special treatment. This configures a permanent tension and, nevertheless, an interdependence between that "demerit" science and the other, a "noble" science. Everything happens as a rivalry, but with moments of alliance and agreement. This triggers modes of operation and division of labor and resources in the

academic world, which affects us daily.

Throughout this text we deal with the transreal numbers, both in the metaphoric sense as in the naming given to the numerical set. In the first case, we assign all scientific ambition to the perfection and radiance of something that goes beyond the real; In the second, it is really the numerical set itself. Analyzing the course of conception and definition of the transreal numbers we call attention to processes that, in dealing with the wandering in the world, refuses any framework within the limits of a mathematics "queen of the sciences".

Mathematics, state science, nomadic science

Transreal Numbers and Possible Worlds

Tiago Soares dos Reis, Federal Institute of Education, Science and Technology of Rio de Janeiro

Elsewhere I, with my co-workers J. Anderson and W. Gomide, use total semantics to obtain a geometrical Possible World Space that models all possible worlds. Total semantics is a logical system that uses transreal numbers to set a semantics that contains classical, paraconsistent, fuzzy and indeterminate values. Our Possible World Space is a Cartesian co-ordinate frame, where each axis is an atomic proposition and every point is a possible world whose co-ordinates are the semantic values of its propositions. Using hypercyclic operator theory we prove the existence of worlds which approximate every world by repeated application of a single operator. That is we prove the existence of universal, possible worlds.

Now I have two research students. We are researching the Possible World Space. Some results are already known from hypercyclic operator theory: (1) if X is a space which has an hypercyclic operator then every vector from X is the sum of two hypercyclic vectors; (2) if T is an hypercyclic operator then any linear combination between iterates of T has a dense image; (3) if T is an hypercyclic operator and x is an hypercyclic vector then every element from the subspace generated by the orbit of x is an hypercyclic vector; and (4) the set of hypercyclic vectors generated by T is equal to the set of hypercyclic vectors generated by T^n for all positive integer n .

We are investigating whether our Possible World Space has the above properties. If so, it follows that, respectively: (1) every possible world is the sum of two universal worlds; (2) every possible world can be approximated by the image of linear combinations between iterates of an hypercyclic operator; (3) the subspace generated by the orbit of a universal world is made of universal worlds; and (4) the set of universal worlds generated by T is equal to the set of universal worlds generated by T^n for all positive integer n .

The second property allows continuous proof paths over hypercyclic iterates. It allows searches and optimisation. The fourth property means that if we generate a counterfactual word from a universal world then we can still get arbitrarily close to any world, in other words actions can be reversed. This gives a mathematical justification for a person to engage in good actions and it justifies atonement for sin.

transreal numbers; total semantics; possible worlds; hypercyclic operators

Naïve Transset Theory and a Proposal of an alternative Methodology of Science

Walter Gomide, Federal University of Mato Grosso - UFMT

Naive transset theory, created and being developed by James Anderson, deals with two disjoint classes, V (sets) and W (antimonies). Each one of these two branches has its own logic, in which the

axiom of excluded middle holds: the universe of sets V is classical, and the diagonal $-\infty, \infty$ of Transreal Square of Opposition is adequate to be its semantic background in such way that the law of excluded middle does not allow any other truth value than True or False; the universe of antinomies W is non-classical, and the diagonal

$0, \infty$ of Transreal Square of Opposition is adequate to be its semantic background in such way that the law of excluded does not allow any other truth value than "dialetheia" or "gap". So we can avoid Russell Paradox, in the extent that this statement deals with an antinomy and, for this reason, the axiom of excluded middle implies that Russel Paradox should be really paradoxical or a gap. If you discharge the possibility of being a real paradox (what is reasonable - paradox implies inconsistency), then gap value remains, and the paradox is solved.

Further we can see that all sets and all antinomies have their "conceptual" counterparts. We can see that these counterparts are properties that divided the universe of concepts or properties into two disjoint sets: the set V^* of properties that obey the law of non-contradiction, and the set W^* of properties or concepts that don't obey law of non-contradiction, and these two sets have the same cardinality as proved by Anderson. Then we can admit that for every classical concept (these ones that obey law of non-contradiction) we can correlate a non-classical concept (these ones that don't obey the law of non-contradiction), which one is the image or a representation of a classical concept. Theses images or representations of classical concepts or properties could be seen as the "imaginary source" of objective concepts, and the logic adequate to deal with them is non-classical, once they correspond to the non-classical diagonal of transreal square of opposition.

The idea here is present a methodology of science based upon this distinction between classical and non-classical properties that arises from Naïve transset theory.

Transreal; Transset; Logic

084. Naissance des géométries au XIXème siècle: entre axiomatiques, modèles et théorie des formes

Chasles et le «Rapport sur les progrès de la géométrie» (1870)

Cleber HAUBRICHS, Instituto Federal do Rio de Janeiro

Ce travail est une présentation commentée du livre «Rapport sur les progrès de la géométrie», publiée en 1870 par Michel Chasles. Je donne ici une analyse de l'organisation disciplinaire des mathématiques (et en particulier des géométries), défendue par l'auteur dans l'Introduction et dans les Réflexions (le dernier chapitre) de son livre.

M. Chasles (1793-1880) a activement contribué dans le champ de la géométrie du 19ème siècle et publié un grand nombre d'articles et de livres dans divers domaines de la géométrie. En outre il a enseigné, et a été le premier à occuper la chaire de géométrie supérieure, créée pour lui en 1846, à la Faculté des sciences de Paris. Dans le cadre des activités scientifiques de Chasles, il y a aussi ses travaux comme historien, où il a fait une exposition historique ou didactique des oeuvres géométriques. Son principal ouvrage historique est l'« Aperçu historique sur l'origine et le développement des méthodes en géométrie », sortie en 1837, qui apporte une vue d'ensemble des géométries depuis l'antiquité classique jusqu'aux premières décennies du 19ème siècle.

Le Rapport, qui peut être entendu comme un deuxième livre de caractère historique (mais qui est, en effet, un livre de comptes-rendus des oeuvres géométriques) est l'objet d'étude de ce travail.

Chasles y mentionne plus de trois cents géomètres et fait des présentations et des commentaires sur la production d'environ quatre-vingts géomètres français actifs dans la période allant de 1800 à la date de publication du livre. Fier de son autorité de géomètre reconnu par ses pairs, enseignant, historien et compilateur, Michel Chasles expose dans le livre de 1870 ses conceptions disciplinaires des géométries. Chasles y tente de mettre en valeur cette géométrie, qu'il appelle « moderne », une

géométrie synthétique inspirée par les oeuvres de Gaspard Monge, Lazare Carnot et Jean-Victor Poncelet. Cette valorisation contraste avec un certain dédain des géométries dites analytiques (c'est-à-dire, subordonnées à des méthodes algébriques et/ou systèmes de coordonnées), attitude qui est de plus caractérisée par l'omission complète des géométries non-euclidiennes.

Chasles; Rapport sur les progrès de la géométrie; Organisation disciplinaire des géométries; Géométrie «moderne»

Retour sur le rôle de Hermann Günther Grassmann dans l'avènement d'une nouvelle pensée géométrique au 19e siècle

Dominique Flament, CNRS

Hermann Günther Grassmann (1809-1877) a sa place dans le renouveau de la géométrie au 19e siècle, et au-delà: sa lineale Ausdehnungslehre de 1844 mériterait beaucoup plus que le modeste rappel que nous ferons. Cette partie de son œuvre mathématique a été au mieux critiquée, mais elle sera surtout ignorée par la plupart de ses contemporains. Aujourd'hui encore, en dépit des nombreux efforts réalisés au cours de ces trois dernières décennies pour y remédier, l'écrit de 1844 demeure peu connu; parmi ceux, rares, qui l'interpellent favorablement, trop peu se sont risqués dans la lecture de cet écrit qui ne cesse d'être «redécouvert». Cette œuvre maltraitée, dont les premières influences tant philosophiques que mathématiques sont considérables, est d'une grande richesse conceptuelle et ambitieuse: une «nouvelle science» est mise en œuvre, elle est «digne» de figurer au sein des «mathématiques pures», entendues telle une «théorie des formes» (Formenlehre), où une Ausdehnungslehre viendra prendre la place d'une «Géométrie» qui en est rejetée parce que considérée telle une «science réelle», et ramenée au plus modeste rang d'«application» (non sans des ambiguïtés que nous évoquerons). Sans volontairement recourir à cette «nouvelle science» (nous verrons pourquoi), la «Géométrie» est dotée d'un «début purement scientifique»; cependant, grâce à cette «nouvelle science», on pourra enfin «voir» en cette géométrie revisitée ce qui s'y «cachait»; l'«objet géométrique» s'affranchit de ses «coordonnées», elles lui sont devenues «étrangères»; outre un «calcul» qui s'exerce directement sur lui, il est possible de concevoir un pensé géométrique qui n'est plus contraint au seul «espace» tridimensionnel familier («donné»): il s'exercera dans un «espace né de la pensée». Algèbres linéaire et multilinéaire,... s'ensuivent et se définissent, se précisent ou se laissent deviner dans cette œuvre singulière, où il n'est pas encore vraiment question d'«axiomatique» contrairement aux premières apparences.

Ausdehnungslehre; Science formelle; Axiomatique; Géométrie; géométries

La vision géométrique et mécanique de Clifford

Gérard Emile Grimberg, Instituto de Matemática, PEMAT-UFRJ

Dans ce travail nous cherchons à dégager au travers de l'étude des articles de W.K. Clifford, la vision géométrique et mécanique qui le conduit à élaborer les éléments de ce qui constitueront les fameuses algèbres dites de Clifford. De son premier article sur le sujet Preliminary Sketch of Biquaternions (1873) à l'article créateur de la nouvelle algèbre Applications of Grassmann's Extensive algebra (1878), il y a tout un processus de conceptualisation qui est le produit à la fois de sa formation anglaise (Hamilton, Cayley, Sylvester, entre autres) et de ses lectures et interprétation des théories d'Hamilton et de Grassmann. Clifford connaîtra d'abord la théorie de Grassmann au travers de la présentation qui en est faite par H. Hankel (1867), puisqu'il ne prend connaissance du texte

même de Grassmann qu'un peu avant d'écrire l'article de 1878 cité. Étudier la vision géométrique de Clifford consiste à suivre au fil de ses articles ce qui dans sa pensée dépend des travaux des géomètres antérieurs tout en essayant de dégager dans le même temps l'originalité de sa démarche. Dès le Preliminary Sketch, Clifford donne à ses objets et aux opérations qu'il définit, une signification géométrique et physique. Dans sa recherche s'instaure une tension entre le local (ce qui concerne les objets et leur sens physique), et le global, la structure algébrique qui gouverne les opérations sur les objets. Nous montrerons que c'est cette tension qui donne une cohérence à la démarche de Clifford.

Algèbre de Clifford, Grassmann et Clifford, Hamilton et Clifford

Jean-Victor Poncelet et l'édition de ses oeuvres (1862-1866)

Jansley Alves Chaves, Universidade Federal do Rio de Janeiro, IM-PEMAT

La période que nous étudions s'étend de la nomination de Poncelet à l'École Polytechnique (1848) jusqu'à la fin de sa vie en 1867. À la fin de sa carrière, Poncelet, octogénaire, décide de réunir dans une collection unique toutes ses publications ainsi que la plupart de ses notes liées à une des œuvres majeures de sa vie, Le Traité des propriétés projectives des figures. Dans ce projet, deux personnages apparaissent comme essentiels: V. Mannheim et T. Moutard, tous deux anciens élèves de l'École Polytechnique organisent, révisent et corrigent les calculs et les dessins de cette édition, au prix de gros efforts, particulièrement en ce qui concerne les Carnets de Saratoff et de Paris, qui avaient été rédigés un demi-siècle auparavant et qui n'avaient pas été publiés. Cette réunion des travaux de Poncelet a été divisée en volumes: Applications d'analyse et de Géométrie tome I (1862) et tome II (1864), Traité des Propriétés Projectives des Figures t. I (1865) et Traité des Propriétés Projectives des Figures t. II (1866). En outre, certains travaux de Moutard et Mannheim sont inclus en annexe. (Pour cette édition, Mannheim et Moutard ont reçu la médaille Poncelet Je ne connais pas de médaille Poncelet – je connais un prix Poncelet – Mannheim le reçoit en 1872 «pour l'ensemble de ses travaux géométriques» (CRAS 79 (1874)) et Moutard en 1879 (CRAS 90)). Nous cherchons dans cette étude à répondre à différentes questions: pourquoi publier les carnets de Saratoff 50 ans après? Quel intérêt du public justifie la nécessité d'une telle publication, après 50 ans, avec tous les développements de la géométrie synthétique et analytique? En étudiant les contributions de ses disciples dans cette tâche de publication, Mannheim, Moutard et des éditeurs Mallet-Bachelier, Gauthier-Villars, nous espérons une meilleure compréhension des objectifs de Poncelet, au-delà de ce qu'il écrit (1862, xij: «[...] réclamer les points de doctrine ou théorie exposée en 1822, dans le Traité des propriétés projectives des figures et qu'on s'était trop habitué, à partir d'une époque ultérieure, à attribuer à d'autres [...]).

Poncelet; Géométrie projective; Mannheim; Moutard

Cayley, Klein et Darboux: autor de la définition des métriques euclidiennes et non-euclidiennes à partir de la géométrie projective

Leandro Silva Dias, Instituto Federal de Educação, Ciência e Tecnologia do Rio de Janeiro

Une des contributions les plus importantes d'Arthur Cayley est le Sixth Memoir upon Quantics (1859), qui définit une métrique des géométries sphérique et euclidienne à partir de la géométrie projective. Felix Klein (1871, 1873) souligne l'importance de ce mémoire dans ses écrits Über die sogenannte nichteuclidische Geometrie, et offre une classification des différentes métriques euclidienne, hyperbolique et elliptique. En réponse à l'article de Klein (1871), Cayley écrit un article On the non-Euclidean geometry (1872) où il définit une métrique hyperbolique sur un disque. Dès

ICHST
2017

1873, Darboux utilise les travaux de Cayley et Klein dans son livre *Sur une classe remarquable de courbes et de surfaces algébriques* et sur la théorie des imaginaires. Outre l'utilisation de la théorie de Cayley, Darboux (1873) a dédié une de ses notes à la fin du livre cité pour traiter ce qu'il appelle la géométrie de Cayley. Darboux et Jordan ont eu une influence sur Klein lors du voyage de ce dernier en France en 1870. Le but de ce travail est d'analyser les interactions existantes entre les différents travaux de ces mathématiciens sur ce sujet.

Métriques de Cayley; Darboux; Félix Klein

Autour des axiomatisations de la géométrie projective à la fin du 19e siècle

Nabonnand Philippe, Archives Henri Poincaré

Durant la période qui va de la fin du 19e siècle au début du 20e siècle, plusieurs mathématiciens (Pasch, Pieri, Whitehead, Veblen...) proposent diverses formes d'axiomatiques de la géométrie projective. L'objectif de cette conférence est d'interroger les diverses d'un tel mouvement d'axiomatisation. Ainsi, je me propose dans un premier temps de réfléchir aux raisons propres à la dynamique de constitution de la géométrie projective (les discussions autour du théorème fondamental de la géométrie projective entre autres) ; puis, dans un second temps, je présenterai plusieurs de ces tentatives en insistant sur les motivations des acteurs ; enfin, en guise de conclusion, je reprendrai cette histoire à la lumière du mouvement général d'axiomatisation des mathématiques à la fin du 19e siècle.

"Géométrie projective" "axiomatisation" "19e-20e siècles"

086. Transmission of Scientific and Technical Knowledge and Techniques across the Ancient Mediterranean World, from local and 'global' perspectives

Geographical knowledge among illiterate crowds in Classical antiquity

Daniela Dueck, Bar Ilan University

In ancient Greek and Roman societies literary, scholarly and scientific texts were created by and circulated among the educated elite, generally and usually comprised of free adult men. Most of the population seemingly did not share various kinds of information and specifically scientific knowledge. Geography was no exception: descriptions of foreign lands, itinerary logs and mathematical geography were all written by scholars and distributed among them. At the same time, practical knowledge of geography in the form of actual acquaintance with remote regions, travel routes and foreign peoples was often the share of non-elite and alphabetic members of the society: merchants sailed and travelled all over the Mediterranean zone and beyond and simple soldiers arrived at frontier countries and met with previously unknown nations. Geography thus circulated in two levels – the scholarly and the practical.

I propose to address the issue of the transmission of geographical knowledge among illiterate sectors of Greek and Roman societies by following two lines of analysis:

1. To examine if and how scholarly geography diffused from the upper educated elite sector down to the crowds.
2. To assess if and how geographical knowledge was delivered among the crowds themselves on the basis of their direct experience.

To do this I'm going to use several kinds of sources. The "up-down" motion of transmission of

knowledge from the scholarly to the illiterate may be revealed through knowledge originally transmitted orally. Pieces of geographical knowledge were included in public speeches and in dramatic plays, both delivered in front of popular and analphabetic crowds who heard these deliveries. Since we have a written record of these performances we may detect through them what was available to the non-reading population at the time. The “popular” motion of transmission of knowledge which circulated among the crowds themselves based on the experience of merchants and soldiers and on rumours emerging from these travels, may be revealed through popular proverbs whose origin was common experience. Both scientific and ordinary geographic details could be revealed also through visual material prevailing in Greek and Roman societies.

analphabetic geography; ancient Greek geography; ancient Roman geography

Aristotle on the Divine in Nature

Daryn Lehoux, Queen's University, Department of Classics

In his monumental *Generation of Animals*, Aristotle struggles openly to understand how bees reproduce. In the end he thinks that the balance of evidence suggests that ‘king’ bees (what we call queens) generate both workers and new kings asexually, and that workers generate drones, again asexually. Drones, alas, generate nothing. In making this case, Aristotle argues that each bee must contain within itself both male and female principles. He compares this mode of generation to that of plants, as well as to that of two kinds of fish, the erythrinus and the channa, which likewise seemed to reproduce asexually. But as he wraps up his discussion of the reproduction of bees and turns next to the sexual generation of wasps and hornets, Aristotle remarks that such a contrast with bees—sexual versus asexual reproduction—should be expected, since, as he puts it, wasps and hornets “contain nothing divine, like bees do.” It is a curious, almost throwaway line, whose import is not elaborated on explicitly.

This is particularly striking insofar as appeals to the divine are not something that Aristotle makes often in his works on nature, nor does he make them lightly when he does so. The present paper will examine this particular appeal to the divine in light of Aristotle’s use of the idea elsewhere in his corpus in order to try and tease out what he finds so remarkable about bees, as well as to shed some light on the functions of the divine elsewhere in Aristotle.

Aristotle; Science and Religion; History of Biology

Reading Aratus through Ptolemy: Astronomical texts and images between late antiquity and the early Middle Ages

Fabio Guidetti, Humboldt-University

It is thanks to the survival, up to the Carolingian period, of a small number of late antique manuscripts featuring Aratus’ didactic poem *Phaenomena*, in the original Greek and in Latin translation, accompanied by introductory treatises, commentaries and illustrations, that knowledge of Graeco-Roman constellations was transferred from late antiquity to the early Middle Ages in Western Europe. These manuscripts were studied intensively, copied, and in many cases contaminated, particularly during the eighth and ninth centuries, when they were used as tools for speculations about the fixed stars, the constellations and their movements. The written and visual information contained in these late antique manuscripts was, however, far from coherent: while the text of the *Phaenomena* as well as considerable sections of the commentaries and the illustrated planispheres were largely based on the astronomical knowledge of the early Hellenistic period, the

introductory treatises, the hemispheres and some images of individual constellations had been modernised as a result of the advances made by Hipparchus and especially Ptolemy in the study of the sky. Both the late antique edition of the *Phaenomena* and the Latin illustrated books of Germanicus' and Cicero's *Aratea* show distinct traces of Ptolemy's influence in their texts and images: the modernisation of the material is particularly significant because these books were not originally aimed at scholars of astronomy but rather at a wider, non-specialist, high-ranking audience. The proposed paper examines some of these Ptolemaic updates as well as the way they are related to the older *Aratean* materials, both written and visual, in order to get a clearer picture of the diffusion of astronomical knowledge in the late Roman world and to shed light on the way materials pertaining to different stages in the development of astronomy were gathered together and transmitted as a wide-ranging, albeit incoherent, corpus of information.

Aratus; Ptolemy; astronomical texts; late antiquity; early Middle Ages

Diffusion of knowledge in antiquity: ancient sundials

Gerd Graßhoff, Humboldt-University

From its beginnings in ancient times, geometric knowledge has not only been documented, distributed, archived or communicated through textual means. A great part of geometric knowledge has been used for the construction, shaping and use of material artefacts. This knowledge was more than just applied geometry. Through the diffusion of technological innovations, this knowledge was transformed in the form of the artefacts itself into a means of communication and knowledge resource. The example of sundials and the geometrical-astronomical knowledge used to construct them illustrates how the knowledge of geometrical forms, conical cuts, astronomical spheres, and the geometrical shape of the earth was altered and diffused in antiquity.

antiquity; sundials; diffusion of knowledge

Ptolemy's Geography: History and mechanisms of transmission

Olivier Defaux, Humboldt-University

Ptolemy's *Geography*, written in the second century CE, contains a catalogue where localities are listed with their geographical coordinates (longitude and latitude) which can be used to produce maps of the known world. The catalogue includes thus a great amount of geographical information on the antique world. Our extant Greek manuscripts, however, contain many differences in the spelling of the place names and in the coordinates. Ptolemy's catalogue has been transmitted through two branches leading to two different recensions of his work. After many decades of philological studies on Ptolemy's *Geography*, virtually nothing is known of the history of the text from the time of its creation to the extant manuscripts, that is, to the late thirteenth century. The challenge is to understand what happened during the transmission and how we can, given these two different recensions, recover Ptolemy's original work.

Ptolemy's catalogue of localities is neither a simple prose text nor a pure set of numerical tables. It comprises both text (toponyms and some short descriptions) and numbers (the coordinates). The geographical information can be understood only when one looks at the maps, which were not always transmitted in the manuscripts and must be reconstructed. Moreover, Ptolemy chose to organise his material in form of a well-structured catalogue that he explicitly meant to be revised and updated. Given these specificities, the paper will examine several examples to show how our

comprehension of the mechanisms of the textual transmission enables to evaluate both recensions of Ptolemy's Geography, and to highlight how medieval Byzantine scribes and scholars transmitted and handled geographical and cartographical material from Antiquity.

Ptolemy; Geography; history and mechanisms of transmission

New Significance for Latitude in Roman Thinking: The Evidence from Portable Sundials

Richard Talbert, University of North Carolina, Chapel Hill

The paper explores the significance of overlooked latitude figures recorded (it seems) between the second and fourth centuries CE. It modifies the longstanding assumption that Ptolemy's Geography and its associated Table of Important Cities (both mid-C2 CE) alone preserve latitude (and longitude) co-ordinates from classical antiquity. Ptolemy's data encompasses over 6,000 locations. What has been overlooked is modest by comparison and limited to latitude. Even so, the figures for over 100 cities and regions/provinces from Britain to Ethiopia and India inscribed in lists (two to three dozen locations typically) on a dozen bronze portable sundials form an instructive set of data from a variety of perspectives:

1. The scope and format of the lists are strikingly similar despite the varied designs of the objects themselves and their widely scattered findspots; together, these 'geographical' portable sundials represent a distinct type.
2. The type cannot predate Ptolemy's Geography because latitude figures are consistently expressed in the concise, user-friendly style of 0-90 degrees and fractions thereof developed by him in reaction to the (in his view) wholly unsatisfactory style used by Marinus. This choice thus attests to Ptolemy's influence spreading widely – by means undocumented – beyond a circle of fellow experts.
3. The range of different latitude figures (up to several degrees) for certain locations confirms the use of diverse (unknown) sources, no doubt including the Geography, but also others notably inaccurate; sometimes, by contrast, a figure more accurate than Ptolemy's is adopted (as for Byzantium/Constantinople). Equally, there are locations (including regions) for which the figure adopted is surprisingly consistent.
4. Use of latitude as the organizing principle of several lists reveals a capacity and predilection for visualization of space latitudinally. But spatial awareness derived from other principles can be detected too, including the periegesis-form chosen by the veteran Aurelius Gaius to commemorate his career: cf. K. Wilkinson, ZPE 183 (2012) 53-58.
5. The cumulative weight of slips and inaccuracies points to an absence of recourse to maps for checking the latitudes adopted. The perception of even educated Romans as no more than minimally map-conscious is reinforced.

This type of sundial merits attention for its intellectual and cultural significance as much as for its chronometric ingenuity.

sundials; latitude; Ptolemy; worldview; Roman empire

087. Scientific knowledge, cultural traditions and global dynamics (ca. 500-ca.1500)

Images, texts, and instruments: material culture and the exact sciences in medieval England

Catherine Eagleton, Smithsonian Institution, National Museum of American History

Scholars studying the material culture of the exact sciences in the medieval period often focus on the textual, the material, the literary, or the visual traditions. Each of these types of evidence brings richness and detail to our understanding of the period, but each has its limitations.

This paper will look across the evidence base for understanding the place of instruments in medieval European (primarily English) scientific enquiry, focussing on astronomy and timekeeping. It will consider the ways in which an approach drawing together different types of evidence, can create a richer account of knowledge and practise in the period.

Specifically, it will argue for a greater understanding of the limited archaeological evidence available, alongside detailed study of instruments preserved in collections, and the need to add to that detailed textual and visual analysis of technical and non-technical sources.

medieval; astronomy; timekeeping; instruments; manuscripts

Nicephorus Gregoras "Treatise on the Astrolabe" in 14-Century Constantinople

Darin Hayton, Haverford College

In early 14th-century Constantinople the quadrivial subjects—especially astronomy and astrology—enjoyed a renewed importance. New schools were established in the capital that advanced the study of astronomy and educated scholars for the imperial court. Reports describe scholars in the imperial palace debating astronomical issues such as time and position of an eclipse or the best way to correct the calendar. This new attention to the mathematical disciplines took different forms. Some scholars adopted and adapted Persian sciences, thereby drawing on the latest advances in astronomy and astrology. Other scholars sought to revive Ptolemaic, that is Greek, astronomy and astrology.

I want to explore this dichotomy—Persian adaptation vs. Greek revival—by examining Nicephorus Gregoras's "Treatise on the Astrolabe," a text that presents the construction and some of the uses of an astrolabe. Gregoras is typically described as one of the foremost proponents of Ptolemaic astronomy in Constantinople. By the time he composed his "Treatise on the Astrolabe" in the early 1330s, he had already established himself as an expert in the mathematical subjects and had composed a work on predicting eclipses. In his correspondence Gregoras seems to have considered his "Treatise" as part of a long, Greek astronomical tradition. He placed his text in the tradition of Hipparchus, Ammonius, Philoponus, and Synesius. He made no reference to Persian astronomers. I will compare Gregoras's "Treatise" with other, roughly contemporary texts circulating in Greek on astrolabes, one of which was attributed to a Persian scholar. By examining Gregoras's "Treatise"—methods of construction, language, mathematics, uses—I hope to uncover his reliance on Greek predecessors or his unacknowledged (or unrealized) debt to Persian scholars. I also want to trace the ways a text on the construction and use of an astrolabe can be Greek.

Astrolabes; Byzantium; Byzantine science; Medieval Science

Peeking into Medieval Education: the Quadrivium in verses by Alexandre de Villedieu

Nadia Ambrosetti, Università degli Studi di Milano

The landscape of Mediaeval scientific treatises with educational purpose includes a small number of works written in verses. Maybe the most prolific author of such a genre is Alexandre de Villedieu, who lived in France over the 12th and the 13th century; he also authored a metrical Latin grammar, which spread across Europe until the 16th century, and some less known poems of religious content. The scientific production in verses attributed to Alexander focuses on the artes liberales, mainly on the quadrivium, ranging from arithmetic to geometry, computus, and music.

In this study, we first examine the *Algorismus metricus* in his relationship with the Arab tradition in Latin translations (Allard, A., ed. *Muhammad Ibn Musa Al-Khwarizmi Le calcul indien (algorismus). Versions latines du XIIe siècle*. 1992, Blanchard: Paris) and with Sacrobosco's contemporary homonymous treatise (Beaujouan, G., d'Alexandre de Villedieu à Sacrobosco, in *Homenaje à Millás-Vallicrosa*. 1954 p. 106–111). Subsequently, we study the paternity of another work, a *De Sphaera*, first attributed to Villedieu by Trithemius (*Catalogus Scriptorum Ecclesiasticorum, sive illustrium virorum*. 1531, Coloniae: Quentel); later historians are unanimous in confirming such an authorship attribution. Then we take into consideration a treatise in verses of the same author about the calendar, his *Massa compoti*. This widespread work teaches how to calculate the dates of movable feasts and other religious celebrations (van Wijk, W.E., ed. *Le nombre d'or: étude de chronologie technique suivie du texte de la Massa Compoti d'Alexandre de Villedieu avec traduction et commentaire par W.E. van Wijk* 1936, Martinus Nijhoff: La Haye). The last work analysed is a *De Musica*, whose attribution is far more recent (Waite, W.G., *Two Musical Poems of the Middle Ages*, in *Musik und Geschichte*. 1963, Arno Volk: Köln. p. 13-34) and controversial (Seay, A., ed. *Carmen de musica cum glossis. By Alexander de Villa Dei (?)*. 1977, Colorado College Music Pres: Colorado Springs). The poems are then evaluated from a historical, a linguistic and a stylistic viewpoint, to determine whether the tradition of scientific works of this author, apparently a prolific and actual polymath, can be accepted as certain or requires further studies.

From a wider point of view, this work aims to contribute to an updated and more certain knowledge of late-medieval scientific education through the investigation of a traditionally prominent figure.

scientific education; quadrivium; Alexandre de Villedieu; arithmetics; computus

Ibn Sina's Monograph on "Cardiac Drugs": The Hebrew Translations and Commentaries

Tzvi Langermann, Bar Ilan University

Is happiness a state of mind? Or is it rather an expression of the material state of the body? In his monograph on "Cardiac Drugs", Ibn Sina (Avicenna, ca. 980-1037) takes the second position: sadness and happiness are due to the state of the pneuma or spirit, a fine, quasi-celestial type of matter whose locus is the heart. As the title indicate, the purpose of the monograph is to describe remedies—potions, aromas, and more—which will ameliorate the material constitution of the pneuma and thereby induce happiness. This is a medical tract, but one whose theoretical basis differs sharply from the Galenism on which medieval Islamic medicine rests—and Ibn Sina's own *al-Qanun fi al-Tibb* is the most comprehensive and influential summa of this medical tradition. This monograph generated considerable interest well beyond Ibn Sina's native surroundings. It was translated into Latin and appended to the numerous early printings of the Canon. Two Hebrew

translations were made, one directly from the Arabic, the other from the Latin version. Moreover, two extensive Hebrew commentaries were written, each one written from a very different point view. My paper will focus on the transmission and reception of this book in Hebrew. I will examine how translators and commentators grappled with this tract, attempting to ingest both the unusual medicine and philosophy it contains.

Ibn Sina; history of medicine; Hebrew translations

088. Comparative Studies of Ancient Chinese and Greek Astronomy

Doing astronomy in ancient Greece and China - how different was it really?

Christopher Cullen, Needham Research Institute, Cambridge

It has long been a common-place amongst historians of science that Greek astronomical thinking was fundamentally geometrical in character, whereas in China astronomers were more interested in codifying numerical regularities in the phenomena and thus setting up predictive algorithms independent of any physical model. Like all stereotypes, that image has a good deal of truth behind it. But as a guide to how astronomical theory was translated into actual practice, this contrast may be misleading. Practitioners of 'Ptolemaic astronomy' were not required to take account of deferents, epicycles and eccentrics in order to use his theory to make predictions of the positions of celestial bodies in the sky. Instead they used a series of tables deliberately designed to avoid the user of the theory having to think about the geometry that underpinned it. In the later history of western astronomy, the shift from Ptolemy to Copernicus to Tycho and Kepler might typically have been experienced in practical terms as the substitution of one set of tables for another. The impression of fundamental change of world-view from one theory to another may thus have been considerably less than it is often represented in popular history of science which sees history through a retrospective lens. In China, however, the user of an astronomical system, *li* 曆, had little alternative to performing all the calculations it specified in order to get a useful result, and user-friendly tables of the western kind were not generally available. It was thus less likely that those without specialist training or study would be able to make use of the systems created and used by professional astronomers, who were largely state officials.

China, History of Astronomy; Greece, History of Astronomy; Historiography of Science; Ancient astronomy; Astronomical tables

An Ancient Chinese Flat Earth Cosmology

Dirk L. Couprie, University of West Bohemia in Pilsen

I will start with a short explanation of the *gai tian* system. The Earth is conceived of as a flat square and the heavens as a flat circular disk, parallel to it. The heavenly bodies turn around the pole of the heavens, which is right above the central point of the Earth. Rising and setting of the heavenly bodies are explained as an optical illusion. Night and day are explained by stating that the Sun on its orbit around the pole shines successively on different parts of the Earth. The seasons are explained by stating that the Sun's orbit is near the pole in Summer and farthest away in Winter. The *gai tian* system has interesting geographical consequences that can be explained by a modern projection method of the spherical Earth as shown in the emblem of the United Nations. I will argue that, in the *gai tian* system, the Sun does not shine like a searchlight, as is commonly interpreted, but as a candle.

The gai tian system elegantly solves the problem of time differences on the flat Earth, which Greek flat Earth cosmology was unable to solve. I will clarify this with references to Archelaus, Aristotle, Pliny, Cleomedes, and Ptolemy. In my opinion, Greek flat Earth cosmologies are fundamentally different from the gai tian system. On the other hand, the ancient Chinese method to measure the distance to the heavens was essentially the same as used by Thales to measure the height of a pyramid. It can be argued that Anaximander, although he is said to have introduced the gnomon, did not use this method, but that Anaxagoras must have made use of it when he said that the Sun is about the size of the Peloponnesus.

The ancient Chinese made, however, an essential mistake in their calculation of the distance to the Sun, which is hard to explain convincingly.

Otherwise than the ancient Greek flat Earth cosmologists, the ancient Chinese made many calculations in the heavens and on their flat Earth. Unfortunately, these calculations suffer from the fundamental mistake in the measurement of the Sun's height.

I will end with a short excursion to modern flat Earth cosmologies (which have a lot of believers, mainly in the USA), the main characteristics of which are, curiously, similar to the gai tian system.

Chinese cosmology; gai tian; Presocratic cosmology; Flat Earth

Comparative study on the astronomical tables listed in the Chinese-Islamic calendar Huihui-li and Almagest : Focusing on the solar and lunar motion tables

Eun Hee Lee, Yonsei University Observatory

In China, Islamic civil almanac was issued and distributed from the beginning of Yuan dynasty (1271-1368) for Muslim people who moved into China from the western region. However, Chinese version of Islamic calendar system, Huihui-li was firstly translated into Chinese in 1385 by the order of the first emperor of Ming dynasty (1368-1644). From this time, Islamic calendar system was officially studied by the astronomers of Chinese astronomical bureau. Generally, it was known that the calendar system of Huihui-li was based on the Almagest, but we can easily find that the astronomical tables listed in Huihui-li are not exactly same with those of Almagest. In this study, we examine on the solar and lunar motion tables of Huihui-li and compare with those of Almagest. Particularly, through the analysis of the astronomical constants recorded in the tables, we will trace and discuss about the observed year and place of the data included in the tables of Huihui-li and Almagest.

Islamic calendar system; Huihui-li; Almagest; Astronomical tables

A 19th century comparison of the Ancient Greek, Chaldean and Chinese astronomical constellations

Fotini Asimakopoulou, University of Athens

During the 19th century, a certain number of studies have been published on the history of astronomy comprising some titles of Ancient Chinese books on astronomy. The interest towards Chinese astronomy arose and appeared the first comparative studies between Ancient Greek, Chaldean and Egyptian astronomy and Chinese astronomy.

Charles Hippolyte de Paravey (1787-1871) was a French Engineer (studies at the Ecole polytechnique and Ecole des Ponts et Chaussées) who wrote a number of books and articles to promote the idea of the unity of Human civilization. A fervent Catholic, he believed in the equality of races and in the unique origin of Humans; to support this idea he compared Western and Eastern astronomical

constellations and zodiacal cycles, hieroglyph languages and myths. In his publications between 1820 and 1835 he compares “Western” (Ancient Greek, Chaldean and Egyptian) and “Eastern” (Chinese and Japanese) constellations and zodiacal cycles. His publications about Ancient astronomy attracted the attention of French astronomers such as Delambre.

In our paper we will present Paravey’s syncretistic ideas between Ancient Greek and Chinese astronomy. We also present his struggle to demonstrate, as a scholar belonging to the milieu of European orientalists, the unity of Human civilization based on historical evidence such as the history of Ancient astronomy.

Constellations, zodiac, Greece, China

Investigating the Heavens and the Earth in Ancient China and the Graeco-Roman World: Zhang Heng and Ptolemy

Fung Kam Wing, The University of Hong Kong

Zhang Heng (78-139) and Ptolemy (c.100-178) are prominent figures of scientific creativity at the beginning of the first millennium. They investigated the heavens and the earth and designed scientific instruments to present their studies. Head of the Royal Observatory and well accomplished in astronomy and seismic study, Zhang Heng of Han China prepared a topographical map and invented a water-driven mechanical celestial globe. Claudius Ptolemy of Roman Alexandria described the construction of an armillary sphere comprising graduated rings in his influential work *Almagest* and made a map of the world known to the Hellenistic period. This paper will demonstrate the different ways of scientific thinking in ancient China and the Graeco-Roman world.

Zhang Heng; Ptolemy; astronomical instruments; ancient geography; scientific thoughts

A Preliminary Study on the Zhongxiu-Daming Calendar: Solar Eclipse

GoEun Choi, Korea Astronomy and Space Science Institute

Ki-Won Lee, Catholic University of Daegu

Byeong-Hee Mihn, Korea Astronomy and Space Science Institute

Yong Sook Ahn, Korea Astronomy and Space Science Institute

We report the preliminary results of the solar eclipse calculation by the Zhongxiu-Daming calendar of the Jin dynasty (A.D. 1115 – 1234) in China. This calendar was made in 1180 as a revised version of Daming calendar which was compiled in the same dynasty, and used until 1280 in the next Yuan dynasty (A.D. 1260 – 1368). As well, the Zhongxiu-Daming calendar had been utilized since the reign of King Sejong (A.D. 1418 – 1450) of Korea together with the Chijeongsan-Oepyeon (Korean version of Chinese-Islamic calendar, Huihui-li) in order to supplement the official calendar, Chiljeongsan-Naepyeon (Korean version of Chinese calendar, Shoushi-li) at that time, particularly for the eclipse calculations. For this purpose, the Jeongmyonien-Gyeosilk-Garyeong (Example Supplement for the Calculations of Solar and Lunar Eclipses Occurred in 1447, shortly Garyeong) of each calendar was also compiled, and remains at the Kyujanggak library of Korea nowadays. Accordingly, in this study, we examine the calculation method and results of solar eclipse referred to the Garyeong by Zhongxiu-Daming calendar, and compare with those of Garyeong by the other calendar systems. When we compare the first, maximum, and last contact times recorded in each Garyeong with those times by the modern calculation, we find that the Zhongxiu-Daming calendar is the most accurate at maximum (the difference is only ~33 s) among three calendars, while the Chiljeongsan-Oepyeon in the first and last contact times, respectively.

A study on the Structural change of simplified armillary sphere in 15th Century

Kim Sang Hyuk, Korea Astronomy and Space Science Institute
Mihn Byeong-Hee, Korea Astronomy and Space Science Institute
Ham Seon Young, Chungbuk National University

A simplified armillary sphere invented by Guo Shoujing (1231-1316) in the Yuan Dynasty is an astronomical observation instrument with a simple structure that an armillary sphere was transformed into. It is known that a simplified armillary sphere, which measured the location of celestial bodies, was influenced by Islamic devices. A simplified armillary sphere was also manufactured in the 15th century Joseon Dynasty. Scholars of the Joseon Dynasty improved a simplified armillary sphere and developed it into two types of devices. One is a small simplified armillary sphere which is a downscaled simplified armillary sphere to take an observation while moving. This small simplified armillary sphere used the horizontal coordinate system and the equatorial coordinate system that could be changed according to need. The other is Sun-and-Stars Time-Determining Instrument where polar axis adjustment and time measurement function were improved by the downscaling. This Sun-and-Stars Time-Determining Instrument was first invented during the reign of King Sejong (reign 1418-1450) in the Joseon Dynasty and manufactured with five types of functions until the reign of King Seongjong (reign 1469-1494). This study conducted an analysis on the historical meaning and structural contents of a small simplified armillary sphere and Sun-and-Stars Time-Determining Instrument which was based on a simplified armillary sphere.

Simplified Armillary Sphere; Small Simplified Armillary Sphere; Sun-and-Stars Time-Determining Instrument; Joseon Dynasty; Astronomical Instrument

What are comets: a tentative comparative study of heavenly order between ancient Greece and China

Liu Weimo, School of Humanities, University of Chinese Academy of Sciences

What are comets? Are they omens? Are they meteorological phenomena or celestial bodies? Different answers to these questions are often taken as marking the differences between East and West, or between ancient Aristotelian and new modern world-views. This oversimplified picture may lead us astray in understanding how ancient Chinese and Greeks built heavenly order and accommodated more disorderly phenomena into their own orderly systems. In this paper I will take some typical explanations of comets in both ancient China and Greece as examples to argue that different patterns for the aetiology of comets in ancient Greece and China may reflect their disparate commitment to establishing heavenly orders.

1. To clear up the ground, I argue that “astrological”, “meteorological” and “astronomical” cannot hallmarks ancient Chinese, ancient Greek, and modern scientific views of comets respectively. Actually, we can find an amalgam of these three views of comets in either ancient China or Greece. A more effective way of comparison maybe focus on their different patterns for the aetiology of comets.

2. Take Aristotle’s theory of comets, which was dominant in the West for 2000 years, as an example. He placed comets in the upper region of the sublunary world (karpnosphere), upon which there are both sublunary and superlunary influences. The lower comets (and shooting stars) are caused by the dense concentration of exhalations (mixture of air and earth) rising from below; while the upper comets (and the Milky Way) are caused by the direct friction from the above, in spite of the celestial

substances uninfluenced. Aristotle's motivation in explaining comets' natural causes was less empirical than architectonic, being led by his commitment to the hierarchical order in the cosmos and the continuity between members of the hierarchy.

3. In ancient China, by contrast, the heavenly order is hierarchically higher than and structurally analogous to the order of human world, but there is neither in-between continuity nor the continuity between members of the hierarchy. People didn't care for the efficient cause of comets; rather, they consider their appearance as a reflection of some disorder in human world, especially inappropriate actions and lapse from virtue of the Emperor (son of the Heaven), which in turn is an opportunity for the Emperor and the royal court to exercise introspections and to amend their political measures.

comets; heavenly order; hierarchy; continuity; comparison between ancient China and ancient Greece

Research and Applications of Solar Eclipse Records in China

Ma Liping, National Time Service Center of Chinese Academy of Sciences

The Sun was the symbol of the Emperor and a solar eclipse was a warning to the Emperor, so great importance was attached to solar eclipses in ancient China. The longest series of eclipse observations in the world were bequeathed to us. Most of them, but not all, were applied to predict celestial phenomena (astrological prediction) and make exact calendars.

Solar eclipse records were sporadic and vague from the Xia Dynasty to the end of the West Zhou Dynasty. The extant systematic Chinese records of solar eclipses originated from the Chunqiu (Spring and Autumn) period. There are 37 solar eclipses recorded in the Spring and Autumn Annals. Solar eclipse records are rather complete from the West Han Dynasty to the end of the Ming Dynasty. The form of these records is quiet concise and formalized. From the late period of the Ming Dynasty, local chronicles became common, which often recorded eclipses and other celestial phenomena, especially the spectacular view of total solar eclipses.

Chinese scholars have done lots of work on solar eclipses recorded in historical archives. The state has also invested a lot of manpower and material resources in the field of astronomical records. Two aspects of the present study of solar eclipses are introduced. One is statistic and analysis of solar eclipse records, which contains studies of original records and canon of solar eclipses. The other is applications of these records, mainly in historical chronology and the secular variation of the Earth's rotation. It is worth mentioning that one scholar used some records of neighbors. Furthermore, records of solar eclipses are also applied in some other ways, such as in checking the precision of the system of calendar, discussing time system, and others.

records of solar eclipses; statistic and analysis; historical chronology; secular variation of the Earth's rotation; China

Cosmos as Parallel Planes: A Comparative Study on Gaitian Theory's Origin

Mao Dan, School of History and Culture of Science, SJTU

JIANG Xiaoyuan, School of History and Culture of Science, SJTU

Three kinds of Gaitian Style cosmological models, or Models for Heaven as Rotating Plane Parallel to Earth, which were recorded separately in pre-Socratic philosophy of ancient Greece, Rig-Veda, Puranas and sutras from India and Zhoubi Suanjing in China, are compared in detail, particularly how they describe the apparent diurnal movement of the sun and explain the formation of day and night. Then, information contained within about latitudes of their birthplaces are analyzed, and their

probable mutual origin in connection with migrations of ancient peoples are discussed, combined with analysis depending on historical comparative linguistics and archaeological discoveries.

Gaitian Theory; Rig-Veda; pre-Socratic philosophy; Puranas; Zhoubi Suanjing

An Investigation on the computation and observation of the solar model in Lixiang kaocheng

Wang Guangchao, University of Chinese Academy of Sciences

It is generally recognized that the computations at the basis of the Chinese calendar were as independent of any physical model of the world. It was not until 17th century that the mathematical astronomy had been changed under the influence of Western astronomy. Lixiang kaocheng 曆象考成 (Thorough Investigation of Calendrical Astronomy) was composed on the basis of Western astronomy introduced by Jesuit astronomers during the 17th century. It was edited in Kangxi's old years (from 1713) and used to calculate the annual almanacs from 1726. This article examines the solar model in the Lixiang kaocheng from the perspective of the relation between theoretical computation and astronomical observation. Different with the eccentric solar model in Xiyang xinfa lishu 西洋新法曆書 (Treatises on Calendrical Astronomy According to the New Method from the West) which was the former calendar in the Qing dynasty (1636—1912), Lixiang kaocheng adopts the double epicycle model under the consideration that computation should be in agreement with observation. Though the observational data which were basis for computing the parameters of the solar model in Kaocheng were accurate but the calendar officials of the Kaocheng failed to construct a more accurate solar model. Moreover, we found that the so-called observational data might be originated from rather than real observations.

Lixiang Kaocheng, Solar Model, Computation, Observation

Ecliptic or Equatorial: A Comparative Study of the Guo Shoujing Star Catalogue and the Ulugh Beg Star Catalogue

Xiaochun Sun, School of Humanities, University of Chinese Academy of Sciences

Fan Yang, University of Chinese Academy of Sciences

The Chinese Star Catalogue by Guo Shoujing (1231-1316) contained equatorial coordinates of 678 stars, more than doubled the number of stars in previous Chinese star catalogues. In the period 1420-1437, using astronomical instruments at Samarkand Observatory, Ulugh Beg (1394-1449) made independent observations and determined star positions of 1018 stars, which was in the tradition of Greek astronomy. An analysis of two star catalogues will show the observational techniques behind them and their accuracies. Both astronomers tried to increase accuracy of measurement by enlarging the astronomical instruments. The Chinese catalogue gives equatorial coordinates of stars. The coordinates were directly read off the armillary sphere, which was mounted equatorially mounted. Sun Xiaochun (1996) suggested that the data of the existent Guo Shoujing catalogue was actually observed around 1380, at the beginning of the Ming dynasty. The Ulugh Beg catalogue gives ecliptic coordinates of stars. Does this mean they were directly measured using an ecliptic instrument? Using Fourier analysis we discover a 3 arc minute systematic error in the declinations, which are derived from the ecliptic coordinates, suggesting the data might be first measured equatorially and then converted to ecliptic coordinates, following Ptolemaic tradition. The 3 arc minute systematic error was caused by the misalignment of the instrument's pole and celestial north-pole. Our comparative

study might throw some light on transmission of astronomical knowledge and techniques between Chinese and Greek traditions.

Star catalogue; Guo Shoujing; Ulugh Beg; Coordinate system

089. Scientific Contributions of the Non-Muslim Communities in the Ottoman World

The mechanical calendar of Taqi al-Din Muhammad ibn Ma'ruf al-Râsid

Atilla Bir, Fatih Sultan Mehmet Vakif University

Mustafa Kaçar, Fatih Sultan Mehmet Vakif University

The mechanical calendar of Taqi al-Din Muhammad ibn Ma'ruf al-Râsid

The 16th century Ottoman Scientist Taqi al-Din Muhammad ibn Ma'ruf al-Râsid describe in his mechanical book *Al-turuku al-seniyye fi al-alât al-ruhâniye* an mechanical calendar giving the Julian and Hijri calendars that is showing the Sun and Moon positions on the Zodiac and the Moon phases . This book is the last exemplar written in the sense of Hellenistic pneumatic and Islamic "The Hiyel" tradition. In this paper the calendar of Taqi al-Din is studied in detail are compared with other similar instruments designed by other Islamic scientists. This instrument is enriched by Taqi al-Din with a Qibla indicator for different localities and facilities for determining of prayer times.

Ottoman; astronomy; mechanical calendars; Taqi al-Din b. Ma'rûf; astronomical instruments

Kirkor Kömürçan and his treatise on a method for multiplication: Çep-rast Kaidesi (Crosswise Method)

Atilla Polat, Istanbul University, Department of the History of Science

Kirkor Kömürçan (1868-1958) who was an Armenian citizen of the Ottoman State, is one of the key figures of the history of education in Turkey. After graduating from Mülkiye Mektebi (the School of Political Sciences) in 1888, we first see him as a teacher of mathematics in Selanik İdadisi (Thessaloniki High School) in 1889. This was the beginning of his lifelong career in education. Besides working in the schools of the State, he also worked in several Armenian community schools and wrote more than 40 textbooks which are mainly on mathematics education and business mathematics.

In this paper, after mentioning his life and works in general, I will focus on his little treatise on a multiplication method which was printed twice; in 1920 (with Arabic alphabet) and in 1943 (with Latin alphabet). The method which he called "Çep-rast kaidesi" (Crosswise method) can be performed by vertical and crosswise operations. This is a well known algorithm for multiplication in the history of arithmetic. Here, I will only show some examples from the treatises on arithmetic from the Ottoman period and then I will try to explain the importance of the method for Kirkor Kömürçan and why he needed to compile a treatise on this topic.

Kirkor Kömürçan; Çep-Rast Kaidesi; crosswise multiplication method; Ottoman mathematics

Non-Muslim Physicians and Scholars and Their Contributions to Ottoman Science: Introductory Remarks and Suggestions for Future Studies

Ekmeleddin Ihsanoglu, Turkish Society for History of Science

The Ottoman Empire (1299-1923) had a multi ethnic and multi-religious character. Within the vast lands of the Empire in three continents namely Europe, Asia and North Africa Turks, Arabs, Greeks, Slavic people, Hungarian and other people who belonged mainly to Islamic, Christian and Jewish faiths lived under Pax Ottomana. The Millet system that guaranteed certain religious rights for non-Muslims helped several communities to preserve their cultural identities and develop their own institutions and pursue various cultural and scientific pursuits.

The 18 volumes of the “History of Ottoman Scientific Literature” edited by E. Ihsanoglu and published in the last three decades has revealed the existence of quite a number of Jewish or Christian physicians and scholars who scientifically were active. These volumes have mainly helped to locate the manuscripts these scholarly authored in Arabic and Turkish. However, the works of these scholars that were produced in their native languages were not identified.

The available studies show that from early decades of the emergence of the Ottomans they were open and keen to host and extend patronage to scholars from neighboring countries. In the first period attention was given to Muslim scholars meanwhile to non-Muslim physicians. The first example was a Byzantine physician to the second Ottoman Sultan Orhan Gazi (r. 1326-1362). The tradition of having Christian and later Jewish physicians in Ottoman court went for centuries and some of these physicians left books which copies reached us. Apart from those scholars who were part of diverse population of the Empire, a group of Andalusian Jewish scholars including physicians and astronomers were settled in different parts of the Empire left important literature that was unearthed recently.

This keynote speech aims to discuss the problematic of studying the unexplored aspects of non-Muslim scholars who were part of the Ottoman Empire and produced books in languages other than Turkish or Arabic and attempts to reveal the scientific contacts between them and Muslim scholars. The framework of these studies will be considered mainly in three intertwined phases. Examples from different phases will be discussed and a call for multidisciplinary cooperation will be highlighted.

Ottoman Science, Non-Muslim Scholars, Scientific Exchange

Dissemination of scientific knowledge in Early Ottoman Society: The Debate on astronomy of Panagiotis Nikousios and Vani Mehmet Efendi

Evgenia Kermeli, Hacettep University Ankara

The aim of this paper is twofold. Firstly I will discuss an unknown manuscript written sometime in the second half of the 17th century. It is a formal Debate on astronomy between two prominent members of the Ottoman elite, namely the official translator of the Porte, the Orthodox Christian Panagiotis Nikousios and the celebrated ulema, leader of the kadizadeli movement, Vani Mehmed Efendi. The two in 1662 engaged in discussion related to new science and the ideas of Copernicus and Brahe. The discussion covered many other subjects ranging from geography to history. Nikousios educated in Italy and being involved in astronomy and astrology, while serving the Grand Vizier Ahmed Köprülü, was the most appropriate partner in the Debate. On the other hand Vani Efendi seems to be well informed and ready to test new knowledge.

Albeit the importance of detailed information, more interesting is the form and the methods used in the dissemination of knowledge. As this was an open Debate many members of the establishment and students of Vani Efendi attended the discussion. The text reveal emotions running high as argumentation from both sides took the form of a verbal duello. Finally this relatively vivid debate

between two Ottomans a Christian and a Muslim readdress our conceptions of the two communities living in a separated ideological bubble.

Astronomy; Ottoman Empire; Panagiotis Nikousios; Vani Mehmed Efendi; Debate

An Evangelistic Venture in the Ottoman Empire: American Missionary Hospital in Konya

Mehmet Ali Dogan, Istanbul Technical University

The purpose of the paper is to present a history of the American medical missionary activities in Konya at the beginning of the twentieth century. I will be particularly interested in the activities of the American Board of Commissioners for Foreign Missions (ABCFM) which was the most substantial American missionary organization in the Ottoman Empire. As a cosmopolitan city in the middle of Anatolia, Konya was one of the suitable places that the ABCFM decided to open a mission station. The American missionaries in Konya distributed copies of the Bible and other religious tracts in the vernacular, opened schools and operated a hospital and pharmacy in order to reach those to whom they referred as the “nominal Christians” of the Eastern Churches. The Western missionaries had concentrated primarily on the many Christian minorities in the Middle East, including Armenians, Greeks, Nestorians, Chaldeans, Copts, and Maronites.

In my paper, I present a brief history of the ABCFM missionary activities in Konya and explain the characteristics of their medical activities in the period that began with the arrival of the first group of medical missionaries, William Schauffler Dodd and Wilfred Post, at Konya until the establishment of the Turkish Republic. Moreover, I investigate the activities of nurses and assistant physicians, including Emma Darling Cushman, Mary Louise Carter Dodd and Rachel North, particularly during the First World War in Konya. I also study the impact of the hospital on the peoples of Konya and the reaction of the Ottoman authorities. Last, examining the efforts of the American medical missionaries in Konya to seek converts among the minorities in the Empire to the Protestant faith helps us understanding the religious, moral, intellectual and social situation in the region.

I use primary sources such as letters, diaries, annual reports, journals, hospital records, pamphlets, and newspapers of the missionaries as well as the secondary sources and pictorial materials.

Ottoman Empire; American Missionaries; Konya

An Austrian Engineer at Service of the Ottoman Empire During World War I: Philipp Forchheimer's Istanbul Days

Mustafa Ince, Istanbul Technical University

Philipp Forchheimer (1856-1933) was an Austrian engineer with expertise in hydraulics and railway construction. He worked in Aachen, Graz, and Istanbul. The subject of this paper is to illuminate his career in the Ottoman Empire which covered approximately 1914-1919 period. Although he worked in Istanbul as the rector of the Engineering School (today's Istanbul Technical University), little is known about his Istanbul days.

Forchheimer worked for a brief while in the Engineering School in Istanbul before 1892. His second visit to Istanbul occurred upon an invitation from the Ottoman Ministry of Public Works. His coming to Istanbul coincided with the eve of the World War I. It was the time when the Ottoman government was in the hands of the Committee of Union and Progress which eventually entered the war to stand with the central powers. The Ottoman government chose Forchheimer on the account

that he was the subject of Austria-Hungary, which was on good terms with the Ottoman Empire then and that he was quite a successful scientist in his field. Moreover, he had the experience of working in the Engineering School previously.

In his capacity as the rector of the Engineering School, he taught the students hydraulics. Along with his academic duties, the Ministry of Public Works charged him with supervising transportation of troops and military equipment by railway as well. In the Engineering School, he collaborated with Ottoman teachers who translated his classes to the students. Around the World War I era, Istanbul became the meeting point of the scholars from especially German speaking world. The Engineering School's academic staff comprised academics like Karl von Terzaghi (1883-1963) who joined the school staff in 1916 upon the recommendation of Forchheimer.

The aim of this paper is to shed light on Forchheimer's academic and professional activities in the Ottoman Empire. Studying Forchheimer's residence in the Ottoman capital gives us new perspectives and insights about the scientific and political conditions of the late Ottoman Empire. Specifically speaking, his relations with his colleagues, his academic and professional circle in Istanbul, his effect on the study of engineering in the city, the transfer of the European engineering knowledge to the Ottoman Empire and the Ottoman government's approach towards the foreign academics.

Ottoman; Austrian; istanbul; engineering; hydraulics

İngiliz Selim Efendi: An European engineer in the service of Ottoman sultan

Mustafa Kaçar, Fatih Sultan Mehmet Vakıf University

Forever, non-Muslim Ottomans or European experts had been find opportunity to work in the service of Ottoman Sultan. The Europeans who might appointed for the great investments of the Stat that was neglected going to convert to Islam after the 1770's.

After that the opportunities were rise well rounded and multiplicity for going to work in the service of Sultan. Some of them as scientists, engineers and educators who were play an important role in the transfer of European scientific tradition to the Ottoman. Interpleader of this European expert's, one of prominent figure is "İngiliz Selim Efendi".

After left his patrimonies, he comes to Istanbul and he lived in Istanbul in 1796-1807. He converted to Islam, he has been entitled by Ottoman Sultan, and he was appointed as a professor in the first European Engineering School Muhendishane which established in 1795 at the Corps of Bombardier "Humbarahane" by the Sultan Selim III.

Besides of all, he worked for translation of "Usul-i Hendese" a geometry book which wrote by English mathematician Bonny-Castle that was one of his professors while he was in Royal Military Academy as a student.

Selim Efendi; transfer of science; Bonny-castel; Engineering school; conversion; non-Muslim expert

Circulation of the Naval Technology, Know-how and Engineers in the 19th century Ottoman Empire

Tuncay Zorlu, Istanbul Technical University

Starting from the late eighteenth century Ottoman Empire witnessed important breakthroughs almost every aspects of naval technology throughout the 19th century.

New vessels including steam-ships, ironclads, and submarines as well as naval factories and arsenals not only changed the conventional Ottoman perception of maritime wars, technology and know-

how, but it also brought about the introduction of new maritime terminology, employment of skillful foreign workforce and training of the Ottoman naval cadres in leading European maritime countries. Ottoman response to the changing face of naval technology, emergence of a new type of Ottoman maritime officer, and pioneering linguistic studies dedicated to the Ottoman naval/maritime terminology will be the focus of this paper.

Ottoman navy Naval Technology Non-muslim Ottoman technicians

090. Science and Orthodox Christianity around the World

Religion and Science in Education Practice: The Case Study of the Tentative School Reform in Serbia

Aleksandar Petrović, Department for the History and Philosophy of Science and Technology, University of Belgrade

The paper considers the 2004 school reform attempt by former Minister of Education and Sports of Republic of Serbia Ljiljana Čolić, affecting public representation of science. Inspired by common Christian and Orthodox thought, the Minister decided not to sign the allowance for the mandatory teaching curriculum for Biology, involving the part of Darwinist theory of evolution. The goal was to mollify the social influence of the Darwinist theory and make space for alternative views, in this case the creationist one. As a result, the teaching of Darwin at schools was suspended for one week. The decision was followed by strong reaction of most renowned Serbian scientific institutions, harsh attacks from mainstream media along with an open public debate with many intellectuals disagreeing with or advocating the Minister's act. It also drew wide international attention. The event, generally seen as Orthodox Church interfering in politics, was promptly resolved with the Minister's resignation.

After more than a decade, there is need to study the reasons for such a vehement reaction opposing the alleged attempt to clericalize the state. Paper presents and juxtaposes two distinct streams regarding the matter and thereby, using such a case as genuine social experiment, reconsiders present relationship between scientific and religious world views. The case is quite specific since if Einstein's theory of relativity, for instance, would be disputed by someone who claims absolute space and time, most probably the critical response would not be political but limited to the scientific community. Therefore, it seems that Darwin's theory has certain marked meaning for religion and politics and that it represents not only scientific achievement but one of the pillars of modernity that demands and provides political consensus among state, media and most part of the intellectual establishment. The polemics regarding the teaching of evolution is not a new one; rather, it has a long tradition in modern educational environment. Accordingly, the paper would investigate such major governmental initiatives in other countries, and what reactions they provoked. Apart from that, it would analyze the standpoints of some prominent scholars, scientists and theologians on Darwinist theory and the theory of creation, as well as the question of the prevailing theory in order to understand the reasons for the dissent and reevaluate the readiness for dialogue.

Ljiljana Čolić; school reform; Darwin

Nature and religion in today's Orthodox Church: the ecological discourse of the Ecumenical patriarchate

Eftymios Nicolaidis, National Hellenic Research Foundation

The raise of the ecological preoccupations during the 20th century lead Orthodox theologians and thinkers to revisit exegetical texts of the Greek Fathers of the Church concerning the relations between humans and nature. Various discourses arose, most of them fostering the idea of a harmonic symbiosis of mankind with nature. Supporters of this idea referred to texts of the Fathers presenting the place of humans inside the Creation.

The Ecumenical patriarch Demetrios (1972-1991) was the first to establish a special date, September 1st, as a date of prior for the environment. His successor, Bartholomeos developed a series of ecological activities such as Symposia, lectures, and publications and intervened about such matters in international fora (for example the European Parliament). In the website of the Ecumenical patriarchate we read that “thus it is that the Ecumenical Patriarchate – in keeping with our own sense of responsibility for the house, the oikos of the world and all who dwell therein, has for decades championed the cause of the environment, calling attention to ecological crises around the globe. And we engage this ministry without regard to self interest”.

In this paper we will present the raise of the ecological discourse of the Orthodox Christianity during the 20th century, the various ideas developed and the ecological discourse and activities of the Ecumenical patriarchate during the last 30 years.

religion, ecology, Orthodox Christianity

Orthodox Church and Science Education Policy in Contemporary Greece

Gianna Katsiampoura, Institute of Historical Research/National Hellenic Research Foundation

The aim of this paper is to present the influence the Greek Orthodox Church has on matters of Education Policy in the Modern Greek state, especially of Science Education. Historically, since its foundation the Greek state is closely linked to the Orthodox Church, which is the institution of orthodox Christianity, the official religious dogma of the Greek state as it is explicitly mentioned in the Greek Constitution.

Since the foundation of the Modern Greek state, nearly two centuries ago, the Orthodox Church plays a key role in every aspect of general policy, and especially in educational policy. It is characteristic that Religious affairs and Education are governed by the same ministry, the Ministry of Education, Research and Religions and orthodox priests are public employees enjoying the status of civil servants. Historically, this interlink of the Church with the State can be easily explained by the privileged relation the patriarch had with the sultan in the Ottoman empire, a status that continued to exist in a different form in the age of the modern Greek state.

Due to its privileged position in the state apparatus, the Orthodox Church and its multitude of official and unofficial organizations could control the educational policy and especially the national curriculum. This control is more obvious in science education. In this paper, I will refer to some interventions in the school science curriculum and their relation to the courses on religion, which still exists in the primary and secondary curricula of the Greek school.

science education policy, religion, Greece, Church

Orthodoxy and Science: Varieties of Engagement and Indifference

John Hedley Brooke, University of Oxford

Recent scholarship on the value placed on the sciences by Christian Orthodoxy has exposed complications that militate against facile generalisation. These can arise, as Efthymios Nicolaidis has

shown for the culture of Greek Orthodoxy, from repeated resistance to forms of scientific enquiry associated with Latin Christendom and Western polities. This was still an issue at the end of the nineteenth century when perceived threats from Darwinism added to pressures faced by Greek scientists to defend the moral virtue of dedicated, altruistic research. The presence within Eastern Orthodoxy of a contemplative spiritual tradition that placed the highest value on ascending to a mystical union with God has been seen as contributing to an indifference that contrasts with the case made for an active interrogation of nature in Catholic and, most explicitly, in Protestant cultures. It is suggested, for example, that lacking in Orthodoxy was a prominent Augustinian theology of redemption based on a literal reading of the Fall-narrative in Genesis. By extension, the empirical investigation and manipulation of nature could not be presented, as it was by Francis Bacon, as redemptive in reversing the effects of a historical Fall. Current scholarship also reveals the diversity of political contexts in which engagement with particular forms of "science" was either possible or viewed with suspicion. As further contrasts are drawn between different forms of Orthodoxy, notably in relation to links with national identity, it is important to distinguish different kinds of indifference and the reasons for them, whether of the Churches towards science or of scientists towards religious doctrine. A disinclination to engage in public on matters concerning the relations between scientific and religious authority, particularly when, as with Darwinian evolution, the science was potentially disruptive, has manifested itself among both scientists and Church representatives. Accordingly, in this paper I shall examine some ambiguities in what engagement with, and indifference to, science might mean. Where indifference has been found in the Orthodox Churches, should it be regarded as simply a reflection of different priorities; a sign of timidity, suspicion or fear; the outcome of a political desire for theological autonomy; or a considered strategy to avoid entanglement with conceivably ephemeral theories?

Orthodoxy; science; engagement; indifference

Dialogue and Conflict about the Publication of Dawkin's "The God Delusion" in Greek

Konstantinos Skordoulis, National & Kapodistrian University of Athens

Richard Dawkin's controversial book "The God Delusion" was translated and published in Greek in 2007, a year after the publication of the original work in English. This publication has followed the record breaking circulation in Greece of the author's previous works: "The Selfish Gene", "The Blind Watchmaker", "River out of Eden" and "Unweaving the Rainbow". By 2007, Richard Dawkins had established, also in Greece, a reputation as one of the world's most important science popularizers and as one of the most important proponents of scientific rationality.

Nevertheless, this reputation has been proved insufficient to regulate the conflict between his co-thinkers and orthodox christian believers that followed the publication of "The God Delusion". Extended book reviews were written in Athens daily newspapers featuring positions in favor and against Dawkins' argumentation unfolded in the book, involving Greece's prominent scientists and theologians. The official clergy, university professors and science educators have been part of the debate. Alister McGrath's book "Dawkins' Delusion" was translated and published in Greek the following year (2008).

In April 2015, Dawkins visited Athens for a series of lectures. His visit initiated a new round of debates in the mass media of the country.

This paper is going to give an account of the events and publications in the mass media (both electronic and printed) following Dawkins' "The God Delusion", in an attempt to explore the inner core of the anti-Dawkins argumentation aiming to reveal the contemporary trends in orthodox christianity in their relation to atheism inspired by science.

This work is part of the SOW Project.

Science and Orthodoxy as an historiographical intervention: The Greeks bearing gifts

Kostas Tampakis, National Hellenic Research Foundation

Is the historical analysis of the relationship between Orthodoxy and the Natural Sciences just another set of case studies to be included in the more general Science and Religion scholarship? This paper would like to argue otherwise. Drawing on the findings of projects NARSES and SOW, especially as they apply to 19th and early 20th century Greece, I would like to point out several ways where the study of the interactions between Orthodoxy and scientific practice hints of new venues of research on the subject. Some of these include the role of prevalent 19th century ideologies, the importance of considering the local contingencies of the emergence of a scientific field and the public role of both science and religion during the era. In the Greek case, the consolidation of an autocephalous Greek Church and the emergence and establishment of a scientific field went hand in hand. Greek men of science, clergymen, intellectuals and literati were active in both these processes. As such, the ideological, cultural and intellectual boundaries between different public roles were easier to transverse, and indeed, the question can be posed whether they existed at all. In short, this paper would like to explore how these local contingencies interacted with transnational and global developments to problematize historiographical categories of analysis in the field of science and religion.

Orthodox Christianity; 19th century; Greece

091. Science and Religion: Exploring the Complexity Thesis

A Humanistic Blockbuster? Jacob Bronowski and The Ascent of Man

Alexander Hall, Newman University

First broadcast in 1973, the thirteen part television documentary series *The Ascent of Man* traces the development of human society across history, via its understanding of science. Beginning with proto-apes and coming right up to date with an episode on genetics and cloning, the series thematically skipped across the scientific ideas most thought to have transformed humanity. A co-production between the BBC and Time-Life Television in the US, the series was a global success, with its author and presenter Jacob Bronowski receiving both critical and popular acclaim for his ability to simply present complex ideas, and eloquently convey a grand evolutionary narrative. The series was intended to convey its author's personal view, and as such, presented a humanist and progressive vision of science. Bronowski deliberately aimed to situate scientific progress and discovery, within its cultural context, often connecting it directly to other human endeavours, such as art and poetry. This paper explores the 'full circuit of mass communication' for this production, from its conception through to reception, contextualising the series within Bronowski's wider academic work. Bronowski's series was hugely influential in a number of areas, from its innovative funding structure, through to the ambition and scale of the shooting techniques and locations used. The series was integral to the emergence of a format for primetime non-fiction documentary television, which is still in use today. This paper questions whether this format, developed further in subsequent major television documentaries such as *Cosmos* and *Life on Earth*, may have affected popular public opinion on the relationship between science and religion. Did Bronowski's attempt to situate science

within human society, as an endeavour connected to art, human emotion, and politics forward a more nuanced understanding of the relationship between science and religion? Or, did the connection of Western scientific development with a humanist tradition, later made more overtly atheist by others such as Carl Sagan, actually help to further the popular conception that science and religion are necessarily in conflict?

science communication; television; evolution; humanism; documentary

‘Somewhere Between Science and Superstition’: Religious Outrage, Horrific Science and The Exorcist

Amy C. Chambers, Newcastle University

Science and religion pervade the 1973 horror *The Exorcist* (1973) and the film exists, as the movie’s tagline suggests, ‘somewhere between science and superstition’. Using recently released archival materials I will show the depth of research conducted by writer/director William Friedkin in his commitment to presenting and exploring emerging scientific procedures and accurate Catholic ritual. Where clinical and at times seemingly barbaric science fails, faith and ritual save the possessed child, Reagan MacNeil (Linda Blair) from her demons. I will discuss the ways in which *The Exorcist* created media frenzy with increased reports in the popular press of demon possessions, audience members convulsing and vomiting at screenings, and the apparent religious and specifically Catholic moral outrage. In this paper I will demonstrate that the official Catholic response to *The Exorcist* was not as reactionary as the press claimed. The United States Conference of Catholic Bishops’ Office of Film and Broadcasting (USCCB-OFB) officially condemned the film as being unsuitable for a wide audience, but reviews produced for the office by priests and lay-Catholics, and correspondence between the Vatican and the USCCB-OFB show that the church at least notionally interpreted it as a positive response to the power of faith. Warner Bros. Studios were however keen to promote stories of religious outrage to boost sales and news coverage – a marketing strategy that actively contradicted Friedkin’s respectful and collaborative approach to working with both religious communities and medical professionals. Reports of Catholic outrage were a means of promoting *The Exorcist* rather than an accurate reflection of the Catholic Church’s nuanced response to the film and its scientific and religious content.

Science communication; mainline religion; Catholicism; medicine; ritual

Creating a New Space for Debate: The Monthlies, Science, and Religion

Bernard Lightman, York University

This paper will discuss how the new English monthlies beginning in the 1860’s, such as the *Fortnightly Review*, the *Contemporary Review*, and the *Nineteenth Century*, rejected anonymity and encouraged contributors to state their own views publicly to allow for open debate and discussion on controversial topics. Whereas the old quarterlies, such as *The Edinburgh Review*, *The Quarterly Review*, and *The Westminster Review*, discouraged the development of a broader, public space to discuss such topics, by insisting that anonymous authors toe the party-line, the new monthlies signal a real change. The paper will discuss the role of the liberal editors of the monthlies, including John Morley and James Knowles, and the contributors to these journals, to the evolving public perception of the relationship between science and religion. It will also analyse the place of a private society, the Metaphysical Society, in the development of a new public space.

Darwin on the Cutting Room Floor: Evolution, Religion and Film Censorship

David A. Kirby, University of Manchester

From 1930 to 1968 movie studios sent their screenplays to Hollywood's official censorship body the Production Code Administration (PCA) –also known as the “Hays Office”– and to the Catholic Church's Legion of Decency for approval and recommendations for revision. These censorship boards made sure that studio scripts met the moral standards of religious groups who were concerned about cinema's impact on the public. This paper uses material from the archives of these organizations to explore how filmmakers crafted stories involving evolutionary biology and how censorship groups modified these cinematic narratives in order to depict what they considered to be more appropriate visions of humanity's origins.

Evolutionary themes often fell victim to the notorious “Hays Code” that was administered by the PCA. In particular, I will discuss how films, including *Murders in the Rue Morgue* (1932), *Island of Lost Souls* (1932) and *Dr. Renault's Secret* (1942), were modified before production or edited after release to play down their inclusion of evolution and Darwinism in accordance with the PCA's recommendations. I also examine how movie censors from the PCA and the Catholic Legion of Decency evaluated the theological implications of evolutionary thought in cinematic stories including any attempts by fictional scientists to “prove” Darwin's theories or to find the “missing link.” I will show how the Catholic Legion of Decency's censure of evolutionary themes in cinema changed after the 1950 Papal encyclical, *Humani generis*, acknowledged human evolution as consistent with Catholic Doctrine. Although I will argue that the Legion's censorship decisions for post-1950 films such as *I Was a Teenage Werewolf* (1957) and *Planet of the Apes* (1968) reveal how the Catholic Church continued to be conflicted about the moral implications of evolutionary narratives.

Evolution; Religion; Censorship; Cinema; Realism

Space, place and complexity: historical geographies of science and religion

Diarmid Finnegan, Queen's University Belfast

How might thinking geographically usefully shape approaches to the history of science and religion? How does the task of taking geography seriously relate to a concern with complexity or, indeed, parsimony? This paper, through interaction with recent work on the history of science and religion, will attempt to answer these questions. In doing so, two issues in particular will be addressed. First, the scope, character and promise of the ‘geographical’ or ‘spatial’ turn for scholarship on the history of science and religion will be explored. Specific attention will be given to questions of scale and comparison. Second, the paper will reflect on how historians of science and religion have deployed spatial concepts and will ask how geographical terminology has functioned in the description and analysis of past relations between science and religion. In conclusion, the paper will suggest how sensitivity to space and place understood as concrete realities and as analytical categories, might inform future work in the field.

historical geography; spatial turn; complexity; science and religion

The Stigmata of Ancestry: Reinvigorating the Conflict Thesis in the US 1970s

Erika Lorraine Milam, Princeton University

In the 1960s, a handful progressive evolutionary biologists and paleontologists crafted a theory of humanity's past in which religious and evolutionary perspectives were woven together to explain the "ascent" of humans from our animal heritage. As political perspectives realigned in the late 1960s and early 1970s, however, the possibility of this dual vision began crumble under the weight of resistance from both sides of a newly articulated political spectrum. On the one hand, reducing human experience to any biological explanation (whether environmental, genetic, or evolutionary) appeared to deny personal agency. This proved extremely problematic for social activists seeking to redress gendered and racial discrimination in the coming decade. On the other, conservative Evangelicals and Catholics increasingly saw evolutionary theories of humanity's bestial origins as a crucial component of "secular humanism," which they in turn deemed a long-standing threat to moral order throughout the twentieth century. In order to prevent evolution from being taught in schools, evangelicals called secular humanism a "gospel"—in effect, an anti-religious tradition that required faith in science to the exclusion of a Judeo-Christian God. Caught in the middle, the progressive evolutionary vision of human nature so popular in the 1960s began to unravel, and the idea of a necessary conflict between religious and scientific perspectives found new traction among high profile scientists and religious figures alike. In short, this paper uses the "complexity thesis" to explore why and how the "conflict thesis" between science and religion came to find new traction in American public discourse during the later Cold War.

evolution; religion; Cold War; United States

Rethinking the Darwinian revolution in light of the complexity thesis

Ian Hesketh, The University of Queensland

On first glance, the Darwinian Revolution and the complexity thesis are incommensurable historiographical concepts. While the complexity thesis is a methodological precept that challenges the historian to particularise the relationship between science and religion within the context of a given time and place, the Darwinian Revolution is a historical framework that provides claims about the development of science and its relationship with religion over an extended period of time. The latter, therefore, is based on a rejection of master narratives, while the former is a master narrative. But as a master narrative, the Darwinian Revolution is a highly contestable one that has served a variety of different themes. It has represented the secularisation of science (Ruse), the rise of a godless materialism (Himmelfarb), the replacement of a theological theodicy with a secular one (Young), the shift from a gentlemanly science to a professional endeavour (Turner), and a transformation in communication and print culture (Secord). It has also competed with the "non-Darwinian Revolution" (Bowler), a concept meant to reflect the centrality of progressive and purposeful forms of evolution that were more palatable to Victorian religious sensibilities. Any rethinking of the Darwinian Revolution, therefore, requires a great deal of complexity in order to come to terms with recent historiographical developments, none more challenging than that represented by the complexity thesis itself.

Darwin, Darwinian revolution, complexity thesis, evolution, historiography

Christian missionaries, science and the complexity thesis in the nineteenth century world

John Stenhouse, University of Otago

Although many, probably most, historians of science and religion broadly endorse John Brooke's complexity thesis, several have raised questions. If grand narratives and global generalisations are difficult to sustain, what sorts of mid-level generalisations are possible? If one of Brooke's main targets was the conflict metanarrative, how now do we write conflict back into our histories without sustaining 'the idea that will never die'? What about power and the politics of history-writing? Whose interests do particular ways of telling the past serve? This paper argues that exploring interactions between Christian missionaries, the sciences and their home (sending) and host (receiving) cultures in the nineteenth century world illustrates the enduring significance and fertility of the complexity thesis. It has always made room to tell stories about both conflict and harmony, providing these are contextualised carefully in time and place and not pressed into the service of selective grand narratives. This paper argues, in neo-harmonist mode, that Christian missionaries and their indigenous collaborators played important roles in making and spreading modern sciences around the world. It also argues, in neo-conflictist mode, that conflicts often erupted within the minds of missionaries who invested heavily in science, between missionaries and their host cultures, and between missionaries and their home cultures. I offer examples of each.

Missionaries, science, complexity, conflict, harmony

"The Harmony Thesis" in the Turkish media, 1950-1980

M. Alper Yalcinkaya, Universidad Carlos III de Madrid

An important outcome of the cultural changes that Ottoman society went through during the second half of the nineteenth century was the gradual development of a rich literature about the relations between Islam and science. This literature was dominated primarily by apologetics, and arguments about the "essential" harmony between Islam and science – a harmony which would become apparent once the Qur'an was interpreted the right way, and the flawed ideas that had entered the Islamic canon were discarded. To many Muslim Ottoman authors, this was an urgent task, as young Muslims who were ignorant of the essence of their religion were enchanted by "materialism," which, in turn, led them astray and turned them into unabashed admirers of Europe. While different versions of such approaches remained popular during the early Turkish Republic, references to the Islamic legacy were somewhat less common in discussions about science during the 1930s and 40s. In the 1950s, however, governmental changes and the intellectual and political climate of the Cold War created a fertile ground for the re-emergence of such approaches. In this paper, I will discuss how the conditions of the Cold War, and the social and political changes in Turkey shaped the discourse about the "harmony between Islam and science" between the 1950s and the 1980s. Focusing on the writings of self-avowed conservative Turkish intellectuals, I will show how the relations between Islam and science, and the qualities of an "authentic" Muslim Turkish scientist were described in the newspapers and journals of the period. I will argue that the late Ottoman discourse about the dangers of materialism was revitalized in the conservative press of the Cold War era to accuse Turkish scientists of communism, cosmopolitanism, or snobbishness. Importantly, such arguments, as in the case of the late Ottoman period, depended on the assumption that Islam could not be in conflict with science. Based on these observations, the paper will dwell on the question of the functions of the discourse about the "undeniable" harmony between Islam and science, and the consequences of the popularization of this discourse by the Turkish press.

Three Centuries of Scientific Culture and Catholicism in Argentina. A case discussion of long trends in Science and Religion in Latin America

Miguel de Asúa, CONICET

Perhaps not quite surprisingly (for reason to be discussed) the amount of historical work on the relationships between science and religion in Latin American countries is rather small. I am trying to at least partially fill this void with a long-term study of science and Catholicism in Argentina, spanning almost three centuries (1700-1960). Implied in this project is the selection of an interpretive framework universal enough to allow for future comparative studies but also sensitive to the local historical and cultural circumstances.

Understandably, the great bulk of influential science-and-religion studies have been concerned with canonical episodes in Christianity and the history of science in Europe and the United States. There have been recent efforts to expand this approaches to other religions and non-Western cultures, such as Brooke and Numbers's 2011 book. Notwithstanding particular cases, the mainstream of Latin American science since Independence from Spain belongs to the Western tradition (I am leaving aside the pre-Hispanic period). But despite some ambiguous cases much of this scientific activity was directly and indirectly derivative, a trait that should not be lost sight of at the time of assessing the relationship between science and religion in the region.

If the extension of the complexity thesis beyond particular cases to embrace large historical periods be admitted, it could be argued that at least in Argentina (and there are good grounds to project this conclusion to other countries in the southern cone of the Americas) an overall trend with respect to the interactions between science and religion could be discerned. This should be characterized by harmonious relations in the eighteenth century, a period of harsh conflict in the second half of the nineteenth century, and some kind of indifference reached by the middle decades of the twentieth century. In turn, this sequence seems to call for further historical explanation, which could be found in the tide of secularization (laicismo, in Spanish-speaking countries). It is the far reaching presence of this process in Latin America in the decades between 1880 and 1920, which looks as a promising vantage point from which to interpret the dynamics of the relationships between science and religion in this region. The possibilities and limits of this approach and its articulation with the conflict thesis is opened to discussion.

Science and Religion; Latin American Science; Science and secularization

Conflict, Complexity, and Secularization in the History of Science and Religion

Peter Duncan Harrison, University of Queensland

For over a century the motif of conflict has dominated the historiography of the science-and-religion field. At one level, it has provided the basic plot for a problematic master-narrative about the history of science and religion. More recently, it has determined the agenda of historian 'myth-busters', whose efforts have been directed at showing the falsity of the conflict myth by establishing the 'complex' nature of science-religion relations. The field has thus been dominated by a co-dependent relationship between conflict and complexity. This paper explores possible future trajectories for the history of science and religion. It will offer an account of the relationship between the conflict narrative and more general theories of Western secularization, suggesting that recent treatments of secularization are directly relevant to an understanding of both the deficiencies the conflict story and its remarkable persistence. The paper also considers whether some revised version of secularization

theory might provide an alternative narrative for a fruitful discussion of the history of science and religion—one that moves ‘beyond complexity’.

Science and Religion; Secularization; Complexity Thesis; Conflict Myth

Revisiting the Battlefields of Science and Religion: The Warfare Thesis Today

Ronald L. Numbers, University of Wisconsin-Madison

Although rumors of war date back to the eighteenth century, the “conflict thesis” achieved wide prominence only in the final decades of the nineteenth. Especially influential were the writings of two Americans, Andrew Dickson White and John William Draper, as well as the works of such Europeans as John Tyndall, Thomas Henry Huxley, and Ernst Haeckel. Despite the fact that numerous scholars have of late decried the distortions to the historical record that result from careless talk of “skirmishes,” “battles” and “clashes” between science and religion, martial metaphors still carry the day. Indeed, war drums still ring loudly in our ears. Regardless of its historical demolition, the warfare thesis still serves too many diverse interests—from the polemics of Christian Fundamentalists and New Atheists to the introductory texts by social scientists—to disappear. It is truly, as historian Jon H. Roberts has put it, “the idea that wouldn’t die.”

conflict, warfare, Fundamentalists, Atheists

Islam’s Complexity: Sir Syed Ahmad Khan on the Relationship Between Science and Religion in 19th Century India

Sarah Qidwai, University of Toronto

For Sir Syed Ahmad Khan (1817-1898), a Muslim reform leader in India, there was no contradiction between science and the Islam. In an 1892 pamphlet in which he outlined his principles of Qur’anic exegesis, he argued that the work of God and the word of God could not be inconsistent with each other. A few years later, he published an article written in Urdu titled, The Stages of Human Development from the Inferior to Superior Stage (1896) in his journal Tehzeeb-ul-Akhlāq (Social Reformer). In this article, he summarized his belief on how species have evolved over time. Khan presents us with a compatible, but complex relationship of science and Islam in the late nineteenth century. The aim of my paper is to introduce readers to Khan and outline the development of his worldview in which he argues for the compatibility of science and Islam. There are two specific cases in his life that demonstrate this development. The first, when he abandons a geocentric worldview based on scientific evidence. The second, his argument for the compatibility of human evolution within Islamic doctrine.

Islam; history of evolutionary biology; India

Incidents of God(s) in the Multiverse: Religion, Science and Technology in AI and AI's Multimedia Exhibitions

Scott Midson, University of Manchester

What is the 'multiverse'? Broadly speaking, it goes beyond the notion of the 'universe' to suggest infinite and infolding possibilities. This openness is often described in religious or spiritual terms, which are used alongside scientific understandings in what might suggest a re-enchanting view. Interestingly, these understandings do not seem to be perceived in reductive or solely mechanistic terms as natural sciences and natural theology, which took a somewhat deistic approach, previously advocated of the material world. Rather, the spiritual is interfused with the material, which signifies a new understanding of not only mechanisms, but also of religious and theological models of the world (and beyond), as well as models of God that interact with it.

AI and AI's recent exhibition in Manchester, *Incidents of Travel in the Multiverse*, explores some of these points, and it is used as a focus for this paper that seeks to address the complex interplay of science and technology with religion and theology in the context of the multiverse. One focus of AI and AI's exhibition is the legacy of Alan Turing's 'thinking machines'. In the imagining of these machines, cognition and spirituality – rather than automation and mechanism – suggest new conceptions of space and time in accordance with the principles of the multiverse. Additionally, although Turing's thinking machines are depicted as representing a posthuman future temporally, given the concomitance of time and events in the multiverse, they are also reflective screens for our own human existence and struggles. One significant struggle manifests in the form of the fallen creator – for the machines, this was Turing himself, who consumed a poisoned apple in response to his suffering through chemical castration that was enforced upon him in response to his illegal homosexuality. Theological and religious motifs are rife in this narrative, and there are striking parallels with the forbidden fruit of the Genesis myth, as well as of the suffering saviour as a Christ-figure that brings promise to a new generation. In this paper, the intersection of the scientific and religious themes brought forth by AI and AI's creative exhibition via these tropes and the broader notion of creation is examined, as a way of gauging and reflecting on how theology continues to inform our attitudes to machines and indeed ourselves, as well as the significance of the multiverse as a paradigm in which these narratives are located.

multiverse; creation; love; theology; posthumanism

Darwin's Publisher: John Murray III at the Intersection of Science and Religion

Sylvia Nickerson, York University

The history of science and religion relies heavily upon publications, be these periodical articles, reviews or books, as an authoritative record of opinion. While these sources are recognized as the product of authorial intent on these topics, publishers are less frequently explored as the creators of platforms within which particular opinions were shared and distributed, or as actors themselves who opened up or closed down space for discussion of these issues. Publishers, as commercial agents, served two masters as both their conscience and material advantage played a role in their decision-making. This paper explores how publishers shaped the science/religion interface within the commercially driven print media in the latter part of the nineteenth century.

The case of nineteenth century publisher John Murray III in particular reveals how the nature of commercial publishing shaped the record of publication. This paper explores how Murray expressed his objection to evolution and 'infidel' writing by withdrawing his support from content that challenged Christianity, and in turn, patronized books that offered a harmonized Christian theology of nature. After 1870 Murray himself wrote an anonymous book that denounced the secularized,

evolutionary view of nature, publishing it himself. This book contradicted the evolutionary origins of the earth, organic life and humanity, an explanation of creation offered by several authors Murray himself published. Yet even while Murray tried to, in his words, tackle the “fashionable Thrones of Geology” and purge the infidelity that had been thrust into modern science, Murray continued to disseminate the evolutionary world-view continuing as he did to publish the works of Charles Darwin, Charles Lyell, and Edward Burnett Tylor. By serving both commerce and conscience, John Murray’s publications reveal both conflict and coexistence within the commercial publishing house.

Darwin; evolution; Christianity; Britain; publishers

Teaching Warfare: The Conflict Thesis in University Textbooks

Tom Aechtner, University of Queensland

The conflict thesis of science-religion warfare is a narrative that has been actively challenged by historians for several decades. In fact, scholars have proposed that rather than mere conflict, historical relationships between religion and science exhibit nuances that controvert ideas of perennial discord. Nevertheless, the conflict model of science-religion interactions has proven to be a resilient holdover from the Enlightenment rationalists, which was further inculcated by Draper and White. Additionally, the conflict model persists in various academic disciplines, and it is still frequently presented to university students as the authoritative account of religion-science history. This paper examines how science-religion conflict and complexity are addressed throughout 21st century university-level textbooks and reference materials associated with a variety of fields. As will be demonstrated, modern astronomy, biology, environmental studies, international relations, philosophy, physics, and psychology introductory publications often contain discredited conflict narrative anecdotes. Therefore, while historians have rejected the conflict model, there remains a conspicuous warfare plotline in contemporary university-level textbooks. A question arising from this analysis is not simply whether the complexity thesis is an efficacious idea, but why it is not being taught in many post-secondary educational publications. Accordingly, the utility of the complexity thesis must also be considered alongside the fact that the textbooks of several fields continue to teach conflict and not complexity to undergraduate students around the world.

Conflict Thesis; Textbooks; Teaching Materials

Lights, Camera, Miracle: The Aesthetics of Wonder and Religious Science in Irwin Moon’s Film Series Sermons from Science

William R. Macauley, University of Manchester

Historical studies of the interplay between science and entertainment media rarely examine how evangelical Christian organizations and religious practitioners have not only challenged but also actively engaged in the production and dissemination of scientific knowledge. After working as a travelling Christian evangelist in the late 1930s, California pastor Irwin Moon formed a partnership with the long-established Moody Bible Institute of Chicago. Under the auspices of the Institute, Moon preached his Sermons from Science to large audiences using live scientific demonstrations to illustrate Christian principles. Moon and his colleagues also established a film production company Moody Science Institute (1945-1996) and made 39 educational films in the Sermons from Science series for lay audiences in the US and across the globe. The films depict spectacular scientific ‘experiments’ and highly detailed observations that serve two primary purposes. Firstly, to promote a

sense of wonder at the intricate beauty of the natural world and, secondly, to render nature as cinematic spectacle that revealed the handiwork divine intelligence. Interestingly, Moon's Sermons from Science did not frame religion and science as incompatible or conflicting worldviews but, rather, complementary ways of interrogating and understanding the wonders of nature. Indeed, the films were conceived and promoted as incontrovertible scientific evidence of an omnipotent God, according to the Christian doctrine of creation. I argue that Sermons from Science portray scientists and scientific work using stereotypes from entertainment media, notably film and television. Further, Moon and his colleagues developed animation, film, and cinematographic techniques to create innovative sequences to convey the notion that modern science offers unprecedented views of the natural world that necessitate a religious explanation. The filmmakers deployed aesthetics of wonder and cinematic spectacle to equate empirical scientific observations with evidence of a divine Creator. The history of Sermons from Science also reveals how film has not only been used to produce and communicate factual knowledge, but also as a rhetorical tool for delineating scientific expertise and legitimating religious claims under the guise of scientific rigour.

Science; Religion; Communication; Film; Aesthetics

092. Science Education and the History of Science: Multiplying Pasts and Prospects

Imaginative Biology: an online resource providing a new approach to Science Education

Daniel Gamito-Marques, NOVA University of Lisbon

This communication presents the website Imaginative Biology, an open access online resource designed for 10th to 12th grade and college-level science teachers, educators and students, and explores its methodology, which builds extensively on research in the history of science in order to improve learning by showing how fundamental scientific concepts and theories evolved through time. Although the idea of using research in the history and philosophy of science to complement science teaching was initially met with skepticism by historians of science in the 1960s and 1970s, historians of science and science educators started to emphasize the pedagogical potential of a historical approach in the last decades, as a means to overcome the perceived crisis in the science education field. Research in history and philosophy of science is increasingly viewed as useful for providing a deeper understanding of scientific concepts and theories, for conveying the nature of science, and developing a sense of how science really works in practice. However, adherence to such approaches has been slow, in part because of a lack of appropriate teaching resources. Web resources constitute a potentially far-reaching possibility for the spread of new pedagogical approaches to science teaching, as exemplified by the successful case of the University of California/Museum of Paleontology's Understanding Science website.

In this communication, the recently launched website Imaginative Biology is presented as a pedagogical tool that builds on the history of biology to enhance the understanding of fundamental biological concepts. The website provides a historically accurate and useful explanation of the development of Darwin's theory of evolution and of the early history of the concept of gene. Drawing insights from the pedagogical proposals of Bruce Alberts, and especially Kieran Egan's Imaginative Education Research Group, the narratives in Imaginative Biology rely on storytelling devices to explain the process that led to a particular discovery and discuss the proposed theories and concepts by presenting them in the context of the scientists' own biography and sociocultural background. Such historical approach to the teaching of fundamental concepts can provide a new way of engaging with students and bringing about learning with understanding in biology courses.

Fairs, Olympiads and the Fostering of Scientific Elites: Youth Science Competitions in Sweden during the Cold War (1957-1989)

Daniel Lövheim, Stockholm University

The production of future scientific elites in Sweden has during the second half of the 20th century taken place under a mixture of national images. The need for economic growth and global competition has intermingled with historically rooted identities of being a country of successful scientists and inventors. Often the main responsibility to foster the next distinguished generation has been placed upon the school system. But the production of scientific elites has also involved industry, media and private organizations. In the network of such actors, other platforms for shaping excellence have crystallized rather than class rooms and high school physics labs.

Many of these contexts for the forming of scientific elites are still unbroken territory in the academic fields of history of science and education. As part of a project idea this presentation seeks to focus on a number of co-operations between state, industry and media that resulted in the establishment of scientific youth contests for Swedish high school students during the Cold War. Even if the arrangements often were motivated by an overarching need to entice as many individuals as possible into scientific pursuits, it was evident that the structure of the competitions had developed in order to differentiate and to motivate an elite. They were designed to find and encourage the top, thin layer of Swedish youth that were the most talented and high achieving.

The competitions were developed in close relation to already existing ones on the international scene. Winners of the Swedish arrangements were invited to participate in the American contest National Science Fair – International, others in the Science Olympiads developed in Eastern Europe. Consequently, Swedish secondary school pupils were taking part in similar events on both sides of the cold war.

From perspectives mainly rooted in the academic fields of history of science and history of education, the overarching purpose of the project is to study and analyze these contests in Sweden and their international equivalents during the period 1957-1989. The analysis will concern the role of these contests as reproduction practices of scientific elites in the tension between democratic and meritocratic goals of education, between high school science and the scientific community, but also with regards to the shifting ideological contexts in which such a (re)production was given meaning.

"History of Science Education"; "Scientific Elites"; "Science Fairs"; Science Olympiads"; Cold War"

Grant Stories: A Historical Perspective on Extramural Funding Practices for Indigenous Education and Research Methodologies in STEM

Jessica C. Venable, McAllister & Quinn

Mainstream institutions have, historically, dismissed Indigenous worldviews, knowledges, research, and science education approaches (Bowman-Farrell, 2015; Harrington & Pavel, 2013). However, in recent years, a literature has emerged articulating Indigenous research methodologies (IRMs), and their distinctiveness from Western, Eurocentric perspectives on inquiry (Denzin, Lincoln, & Smith, 2008; Kovach, 2009; Smith, 1999 & 2012; Wilson, 2008). This has coincided with increased need for IRM scholars, practitioners, and educators – like others -- to secure extramural funds to support their activities. But questions remain as to how the U.S. federal grant making enterprise has accommodated Indigenous frameworks in research and science education. This work explores the historical trends in how the federal funding enterprise for science, technology, engineering,

mathematics, (STEM) research and education have understood and attempted to make space – or not make space – for IRM approaches.

Indigenous Research Methodologies; Grants; Federal Funding; STEM; Epistemology

The Problem of History in Chemical Education: The "Nature of Science" as Contested Space

John C. Powers, Virginia Commonwealth University

Recent work in science education, specifically chemical education, recommends that the use of historical anecdotes and case studies in chemistry courses increases student engagement and, also, satisfies the Next Generation of Science Standards' call for instruction in the "Nature of Science" (NOS), which aims to help students understand scientific practice and how scientific knowledge is generated. This is not the first call for the inclusion of history into chemistry courses, a practice which dates back to the 1920s in the United States. These calls, however, have been largely unsuccessful. This paper examines why programs for including history in chemistry courses and curricula have been unsuccessful. I suggest that professional chemists, chemistry teachers, and historians of chemistry (or science, generally) have differing views about what the "Nature of Science" is and, thus, it is a contested space. Historically, the purpose of the history of chemistry from the viewpoint of chemistry educators – to generate student interest and engagement with science, while portraying the sciences in a positive light – does not always mesh with the view of professional historians of chemistry. It was not always this way. In 1925, Edgar Fahs Smith, President of the American Chemical Society could publish a paper espousing the joys of the history of chemistry and its uses in motivating chemistry students. This blissful collaboration began to erode as history of science/ chemistry became a professional activity in the middle of the 20th century. By 1974, Stephen Brush, giving voice to the concern that the historian's approach might not be appropriate for beginning science students, famously asked, "Should the History of Science Be X-Rated?" The relationship between historians and science educators reached its nadir in the 1990s during the so-called Science Wars, when some historians and other science studies scholars were accused of scientific relativism and anti-science views.

I conclude by showing that, despite this recent history, chemistry educators have been incorporating professional historian's work into their published chemistry and history of chemistry courses as NOS curriculum, although mostly via second and third hand sources. I suggest that historians of chemistry need to increase their engagement with chemistry educators (and just get over ourselves!).

science education; history of chemistry; nature of science

Science for grown-ups: historical landscapes of adult STEM learning in the post-war United States

Karen Rader, Virginia Commonwealth University

In contemporary American public discourse, successful STEM (science, technology, engineering, and math) education is so often linked to innovative K-12 learning, "workforce pathways," and "national prosperity" that it is easy to forget: these alignments are a relatively recent historically- and culturally-specific phenomena. This talk offers an overview of a project that will investigate a variety of case studies from the history of post-war U. S. adult science education, as a means of recovering the diverse 'historical landscapes' for understanding STEM learning in twentieth century North

ICHST
2017

America. These case studies, collectively, point to how U.S. science education advocates and practitioners -- as recently as the 1950s -- composed, elevated, and explored a broader array of goals and audiences for STEM learning in America than those that currently dominate the political discourse. Understanding this history more fully illuminates how the current state of science education is the result of a contingent and on-going post-war negotiation over the cultural identities, meanings, and spaces of science pedagogy. In turn, such a humanistic approach could begin to re-shape the contemporary conversation over the problems and possibilities of life-long STEM learning.

science education; pedagogy; STEM

Popular Genres of Science Education and the Normative Uses of History of Science in the post-National Science Foundation Era in the United States

Katherine Pandora, University of Oklahoma

Lessons in scientific content convey – often explicitly, but always at least implicitly – claims about the nature of science itself. This is also true of histories of science. Answers to questions such as “When did modern science begin?” are more than exercises in historical periodization: they display massive cues of preference in defining the nature of science itself in social, intellectual, cultural, and moral terms. Examining how and when science education projects make use of history of science can highlight periods when defining the nature of science possesses significant ramifications for various stakeholders.

A key example is whether or not scientific method in the present is seen as having been established successfully several centuries ago, or whether it is seen as still undergoing definition. The first model portrays the nature of the scientific enterprise as a settled matter, which includes the social relations of professional scientists to the larger polity. The second model presents the nature of science as emergent and still being formulated, which accommodates variation in who does science and how and toward what ends. Both of these perspectives informed influential instances of post-World War II science education in the United States, making significant contributions to vernacular conceptions of the nature of science.

The “venerability of science” model was prominently championed by Harvard President James Bryant Conant in his manifestoes on the role that history of science should play in teaching science in college and in high school, and informed popular science education as well, as in Walt Disney’s 1954 television documentary, *Our Friend the Atom* (which was also shown in classrooms and circulated in book form). The alternative model – of science as hardly just begun – was widely distributed in the 1960s and 1970s in such sources as National Geographic’s video documentaries of Jane Goodall’s research on wild chimpanzees and the series that aired as *The Undersea World of Jacques Cousteau* on commercial television. In these latter sources, the scarcity of information about primate behavior and ocean ecology portrays science as being developed *de novo*, with a history that is less than a generation old. The visibility of these two models suggests that the uses of history of science in contests over scientific authority through science education can be considerable, and deserve further attention across cultures.

science education; popular culture; epistemology; professionalization; STEM policy

Teaching historical practice practically – understanding science culturally

Peter Heering, Institute of mathematic, scientific and technical literacy, Europa-Universität Flensburg, Flensburg

Science education has moved from a concept that focuses mainly on the transfer of knowledge to an understanding of science and an understanding about science. To go one step further, it appears necessary to enable students to develop an understanding of scientific knowledge as the product of a cultural activity. In this respect, it appears to be particularly relevant to enable students to develop an understanding of the cultural dimension of experiments and experimental practices. In this respect, the analysis of experiments with the replication method is extremely fruitful. It enables students to develop a broader understanding of experimentation either through the embedding of the findings from case studies or the actual use of reconstructed apparatuses in teaching. In the presentation, some examples from teaching both at secondary school level and in teacher training at the university will be presented.

science education; historical experiments; cultural approach; practice; replication method

093. Specificities of scientific or scholarly documents as a reflection of curricula

Using historical texts in the teaching of science in the 19th century: the point of view of scholars

Arnaud Mayrargue, CNRS / SPHERE

At different times, scholars have been involved in program design, and some have discussed the relevance of the introduction of history and, in particular, history of science in curricula. The aim, which will be interesting to analyze in this symposium, was to promote a better transmission of knowledge. We shall first examine the arguments put forward during the 19th century which led to the introduction of the study of historical texts into the curricula of science education in France and the functions assigned to it, echoing the publication of scientific Treaties and Lectures ; in a second step we will see how a test on the methods of history of science based on the analysis of scientific documents has been introduced in the exam program (agrégation) and the arguments put forward to remove it a few more years later.

This presentation should make it possible to better understand the specific image and status that scientists wanted to give about their research activities.

History of Energy, History of Light

Learning the Mathematics of Management in the Diyala (Mesopotamia, 2000-1600 BCE)

Carlos Henrique Barbosa Gonçalves, University of São Paulo

This study focuses on the uses of quantification and measurement in legal and administrative texts. The setting is the region of the river Diyala, home to the Kingdom of Eshnunna, a political unity playing an active role in the international scenario during part of the Old Babylonian period (2000-1600 BCE).

In the examined texts, there are abundant examples of the use of quantification and measurement. The scribes who produced them were involved in the management of several aspects of life, more than often not on their own interest but on that of the people who employed them. These aspects included the sale of state property, the setup of loans, the reception of donations to temples, the control of stored items, inheritance procedures, the collection of city tributes and the general flow of people, animals and commodities.

The aim of this presentation is to relate the surviving textual evidence to the skills necessary for scribes to use quantification and measurement. The analysis of the texts made so far indicates that scribes had not only to master the strictly technical mathematical and metrological knowledge but also to develop a discernment as to the context of application of this knowledge: when and what to count and to measure were thus learned skills. Furthermore, even if there was not an explicit management curriculum, the administrative practice was conceived in such a way that its performance was also pedagogical.

Mesopotamia; Diyala; administrative practices; mathematics; metrology

Curricular structures in some cuneiform mathematical texts

Christine Proust, CNRS & Université Paris Diderot

Two types of cuneiform mathematical texts dated to the Old Babylonian period (early second millennium BCE) reached us: school exercises written by young students in the early stages of their training, and texts written by advanced students or scholars. The former inform us, sometimes quite precisely, on the elementary mathematical curriculum. Advanced mathematical cuneiform texts written by scholars are the most often in the form of lists of problems with procedures, in some cases as part of an educational project, in other cases not clearly. In this presentation, I analyze how some elements of curriculum, being elementary or advanced, can be perceived through some lists of problems.

curriculum; mathematics; cuneiform; Sumerian; scribal school

Should headings of sections in Writings on mathematics 算書 (before ca. 186 BCE) be interpreted as a curriculum?

Chemla, Karine, SPHERE (CNRS & University Paris Diderot)

Daniel Patrick Morgan, CNRS-Univ. Paris Diderot-University Paris Panthéon Sorbonne

Karine Chemla, CNRS-University Paris Diderot-University Paris Panthéon Sorbonne

In the winter of 1983–1984, archeologists excavating Zhangjiashan tomb M247 in Jiangling, Hubei, unearthed from this tomb sealed in ca 186 BCE the bamboo manuscript Writings on Mathematics 算數書, marking an important first for the history of mathematics in early imperial China. Structurally, the Writing on Mathematics manuscript is composed of 69 independent sections, each of which begins with a heading written in the upper margin. Curious to know whether both were in the same hand—if the headings, for example, were later added by a reader—we conducted a graphological analysis of the manuscript in 2014. We found two hands, A and B, but not where we expected: generally speaking, A wrote the body, and B wrote the headings, which would seem to indicate that B was last; that said, A also wrote a heading, B wrote part of the body, and several sections reveal an alternation back and forth. Joining contents and codicology, we were able to conclude that Hand B is the leader of this exchange, which we hypothesize to be educational in nature (see our joint article in Jianbo 簡帛 2016, 12). It is to the “headings” that we return in this talk, asking how we can interpret the fact that 68 out of 69 titles are written by Hand B. The talk will explore the hypothesis that these “titles” might in fact have represented a form of curriculum that Hand A had to take in the learning of mathematics.

history of mathematics; early China; manuscript culture

The Geometria subterranea Manuscripts (1600-1750): Knowledge Transmission in practical Context

Morel Thomas, Laboratoire de Mathématique de Lens

During the 17th and 18th centuries, mining surveyors wrote numerous manuscripts about the use of practical geometry in the mines, most of them under the generic name of Geometria Subterranea. To adequately understand these sources, it is crucial to consider the context in which they were used, namely the training of new mining officials and engineers.

To this aim, I will firstly present the cultural context of the mining states, focusing on the scientific and technical training. In a second part, I will present several manuscripts and see how their structure can only be fully understood by seeing them (at least partly) as textbooks. I will finally point out an essential tension between the theoretical content – including Euclid's Elements – and its practical applications. This reflects the ambivalence of the Geometria subterranea, a discipline that had to be both scientifically grounded and concretely useful.

practical mathematics; subterranean geometry; mining history; history of mathematics teaching

A case for professional education in the Old Babylonian Kingdom of Larsa

Robert Middeke-Conlin, Max-Planck-Institut für Wissenschaftsgeschichte

How were administrators educated in the Old Babylonian Kingdom of Larsa? Is there evidence for professional educations or in-situ learning within this kingdom? How, if at all, can we detect such a professional education? This paper begins to answer these questions by surveying both mathematical texts produced in scholastic environments, as well as administrative texts produced in professional settings, in order to produce an image of scribal education as it pertained to professional practice. As a case study, this paper examines evidence from a bureau of irrigation and excavation works to inquire whether a professional education existed and whether such an education incorporated a more general education. From this study, potentially hidden curricular structures, which differ from a more general education that existed within the Kingdom of Larsa, and which are specific to the professional setting of this bureau, will be posed.

Education, Numeric Literacy, Assyriology, Irrigation

094. Science In Their Own Wor[l]ds: Histories, Ontologies and Knowledge-Making from the South

From the Banks of the Irrawaddy: 'Earth Oil', Empire and War in the Long Nineteenth Century

Sujit Sivasundaram, University of Cambridge

Divergence continues to be a heated topic of world history today. Through the decades, commercialisation, industrialisation, the 'Scientific Revolution', the causal relation of Protestantism and capitalism, the definition of property rights, the control of population and orientalist cultural

knowledge have all been held up as holding the key to the rise of Europe. The debate over divergence is related to what the panel organisers term narratives of 'stagist development.' This paper takes up the role of fossil fuels in divergence and argues for a complication of the passage from wood to coal to oil. The focus is not on the Irrawaddy but on a range of extractive relations which allowed kings and colonists to meet and compete on this great waterway, as grand wars were fought between the Burmese and the British. The first Anglo-Burmese war illustrates that there was a tussle over wood, oil, fire and coal, all at the same time, and that in this tussle, knowledge of nature was prized by both the Burmese and the British. Even after the third Anglo-Burmese war, when corporatized geology gained access to Burma's oil fields, traditional hand-dug wells and their hereditary technicians sat alongside the drilling rigs of Western experts. This means that instead of straitjacket histories of convergence and divergence - or indeed, of modernisation and the Anthropocene - one is left with the unexpected transitions in a specific place. Europeans learn about petroleum from Asians and Asians locate knowledge of geology alongside their own techniques of digging minerals out of the Earth. Extrapolating outwards, this is also an attempt to illustrate what a global history of natural history might look like. Global forces did work on the Irrawaddy, spreading armies and navies equipped with scientific knowledge; yet these forces did not create uniformity everywhere, nor did the globalisation of scientific understanding follow a singular track or teleology, or a path without friction and resistance. It is argument for stickiness in understanding the politics of oil and science.

science and empire; global history; divergence; oil; Burma

Experimental Seed Camps in Mexico Before the Green Revolution

Gabriela Soto Laveaga, Harvard University

In the mid-1920s a series of free agricultural schools were created in Central Mexico. In addition to teaching farmers about sowing and harvesting new seeds, farmers were encouraged to challenge "bourgeois" forms of education, especially when it came to scientific knowledge. These schools, steeped in the social reform of post-Revolutionary Mexico encouraged farmers to observe, experiment, and create new strains of corn, beans and wheat. Farmers were led by an Indian-born exile and supported by the famous Mexican muralist, Diego Rivera. Merging art, revolutionary thought, and science this new way of approaching scientific discovery created a new understanding of the role of science and, in a way, a new language to describe experimentation, especially experiments with hybrid seeds. This paper discusses the creation of the schools and their broader meaning by using them to examine the role of scientific agriculture knowledge in the global south. By doing this I illustrate that much of what we understand to be from the era of the Green Revolution - farmer education and experimentation with hybrid seeds - had become part of Mexico's post-revolutionary education in the 1920s, decades before the arrival of American technocrats and agronomists.

Mexico; hybrid seeds; India; wheat; corn

Health, Medicine, and Experimentation in Precolonial Africa

Neil Kodesh, University of Wisconsin-Madison

Over the past two decades or so, historians of have developed a complex literature on practices of health, medicine, and science in Africa. This rich literature focuses in large part on the twentieth and twenty-first centuries and explores four related themes: the effects of conquest and colonization on

ICHST
2017

the health of Africans; the role of Western biomedical and scientific discourse in constructing colonial subjects; the creative ways in which Africans have expanded their therapeutic repertoires in this context; and most recently, the rise of global health science and the place of vernacular science in the current era of global health. Despite the many significant insights in this literature, however, we still know relatively little about the history of health, medicine, and experimentation in the interior regions of sub-Saharan Africa prior to arrival of the first European explorers and missionaries in the mid-nineteenth century. This paper will discuss the methodological challenges involved in writing such histories for regions in Africa where the first written sources do not appear until the second half of the nineteenth century. In the part of the paper, I will draw on several examples to illustrate how historians unearth the early history of these regions through a multidisciplinary method that includes historical linguistic evidence, oral traditions, and comparative ethnography. The second part of the paper will then turn to the ways in which the hard work of developing the early histories of these regions provides novel perspectives from which to examine the histories of medicine and science in colonial Africa.

Africa; medicine; precolonial

Early Caribbean Ontologies: Black Knowledge-Makers and the Imagination of the Natural World

Pablo F. Gómez, University of Wisconsin, Madison

Scholars have conceived the Caribbean to be a paradigmatic place of intellectual and cultural fragmentation; a historical space defined by its fluidity, interconnectedness, and creative resistance. The fuzzy boundaries of the region have served as focal points for the articulation of foundational historical narratives linked to the rise of modern science and biomedicine including those related to natural history, capitalism, scientism, and racism (among others). Such types of historical analysis are dependent on seemingly unavoidable ontologies of relational dualism between nature and humans, and nature and culture. This paper uses a series of cases coming from seventeenth and eighteenth-century black Caribbean locales to reflect on the methodological possibilities for writing histories of knowledge-production about the “natural world” that do not depend on imposed “modern” ontological models. It does so by exploring how black Caribbean knowledge-makers produced powerful novel ontological frameworks that persisted in the region in ensuing centuries. Most historical analyses treat the Caribbean as a shattered place of displacement from which Europeans extracted “objective” information about the natural world. In these histories, Caribbean knowledge-makers of African descent are either reproducers or adapters of Old World mores for engaging with a natural world they do not objectively understand, or intermediaries for the collection of data to be processed by Natural Historians. In other words, the early modern Caribbean does not appear to be a place of creativity and innovation. It is, rather, a historical space that serves as a reservoir of materials to be inscribed in epistemologies that are imagined elsewhere. As part of this early modern transformation, black Caribbean people, and the knowledge they produced, became case studies to be analyzed through the lenses of cultural/religious analysis. The model discussed in this paper goes beyond histories of epistemological obscuring and cultural analysis to recognize how early modern black Caribbean knowledge-makers created novel systems of thought explaining the very nature of the world.

History; Caribbean; African/s; Ontology; Natural-World

Beyond Centre-Periphery: Hypercolonialism, Braided Sciences and the Microhistory of Physiograms

Projit Bihari Mukharji, University of Pennsylvania

For too long the centre-periphery debate has structured studies of colonial science. This has led to the neglect of a vast array of scientific activity that, though happening in the time of colonialism, does not really fit into the centre-periphery straitjacket. One of the most prominent parts of this neglected corpus is the scientific activity that took place in minor colonial enclaves tucked within larger colonial empires. In South Asia, for instance, tucked in the midst of vast swathes of British colonial territory were a series of scattered and tiny French, Portuguese, Danish, Dutch, and even Norwegian colonies. Some of these were assimilated into the British Empire only by the middle of the nineteenth century, while still others lasted into the middle of the twentieth century. The scientific cultures of these tiny colonies can hardly be folded into the neat binarism of centre-periphery models. One such colony was the city of Chinsurah in Bengal. Between the seventeenth and nineteenth centuries, it had passed successively from Portuguese, Dutch, and British control. Moreover, it was a stone's throw from the main French settlement in Bengal. It was in some ways, what Ruth Rogaski has called, a "hypercolony". Neither "Europe" nor "India" were coherent, monolithic entities here. The best way to study the scientific production of such hypercolonies is, I contend, through the figure of "braided science" and by focusing on microhistorical analysis of specific actors, texts, and ideas. This paper will elaborate on these themes by interrogating a physiology textbook, *Dehatmik Tattva: A Discourse on Materio-Spiritualism based on Science and Religion*, written by Dr Brojonath Shaha in 1891.

South Asia; Physiology; Colonial Science; Braided Science; Microhistory

095. Science and history: historiographical production from the scientific communities in Brazil and Mexico

The Contribution of the Periodical *Minerva Brasiliense* for the Institutionalization of Sciences in the Empire of Brazil

Alex Gonçalves Varela, Universidade do Estado do Rio de Janeiro

We aim to analyze the Science section of *Minerva Brasiliense*, a periodical that circulated between the years 1843 to 1845. During the nineteenth century, the spaces of dissemination of scientific knowledge were diverse, such as conferences, illustrated magazines and the press. One of the sections of the periodical was dedicated to the sciences, and numerous works were published in the most diverse areas of knowledge. One of the sections of the periodical was dedicated to the sciences, and numerous works were published in the most diverse areas of knowledge. As for their writers, the newspaper referred to them as follows: "collaborated by men of science and scholars", that is, the newspaper announced the existence of scientists (men of science) and literati (scholars) collaborating side by side. Several articles were published by important men of science in the different branches of knowledge, thus serving as testimony of proof that in nineteenth-century Brazil there was production of scientific knowledge. The *Minerva Brasiliense* was a space of dissemination of the production of knowledge realized by the men of sciences that lived in the Empire of Brazil, whether they were nationals, or foreigners who lived here. The texts published by the authors in the science section were dense, detailed, rich in information, rarely presenting images, and requiring the prior knowledge of their readers. The studies were characterized by involving research, and were originals and meritorious works. They were written by experts in their respective fields of activity, who were concerned to make their scientific research public. Scientific texts were not intended for

the working classes, but for the elite responsible for the production of knowledge in the Empire of Brazil in the 1940s. The texts published in the journal *Minerva Brasiliense* reveal utilitarianism and pragmatism as characteristics of the scientific practices of the men of science of the Brazilian Empire. This fact reveals the continuity link between the latter and those who acted in the Luso-Brazilian Empire in the context of enlightened reformism. In addition, it reveals how much these scholars were updated with Modern Natural History, that in its essence was pragmatic and utilitarian. Therefore, the journal *Minerva Brasiliense* occupies an important place of contribution for the process of emergency and consolidation of the sciences in Brazil Empire.

Minerva Brasiliense; scientific divulgation; Brazil Empire; nineteenth century

Scientific Memory in the Historical Sciences Mexico: Geology in the early 20th century

Lucero Morelos-Rodríguez, National Autonomous University of Mexico - Geology Institute

Among the new scientific disciplines practiced in nineteenth-century Mexico is Geology, which emerges as a professional practice of engineers trained in the College of Mining, later National School of Engineers and later at the Geological Institute of Mexico. In addition to their contributions to the knowledge of the mineral resources and the natural phenomena of the country, they carried out important work in recovering the history of their activity through the preparation of biographies, books, articles and bibliographies, which account for the trajectory and disciplinary tradition. This paper seeks to make a historiographic account of the geological sciences, from the disciplinary narrative and uses that made history engineers and professors to forge their scientific memory. Punctually will analyze the works produced by the pioneers of Earth Sciences in Mexico, considered the “heroes of Mexican Geology”.

Memory, identify, geology, Mexico, 20th century

Brazil in Historiography of Science

Maria Amélia Mascarenhas Dantes, Universidade de São Paulo

World production in History of Science has changed deeply at the second half of the twentieth century. One of the most significant changes was the development of History of Sciences of the so called peripheric regions, such as Latin America. First, this change was consequence of the constitution of local communities of professional researchers dedicated to the historical study of national sciences. It was also based on the methodological transformations of History of Science and the exponential growth of social studies of science.

In Brazil, the production in national History of Science started to grow in the 1980s and diversified significantly in more recent years. Initially, it was fundamental for Brazilian historians to dialogue with the scholars from other Latin American countries, enabled by the action of Latin American Society of History of Science and Technology (SLHCT) which implemented methodological debates about the questions related to the historical studies of sciences in peripheral regions.

The objective of this communication is to present an analysis of Brazilian historiographical production of the last thirty years and the dialogues that it has kept with world production. Among other things, we observed that, in the first years, scientists and institutions were chosen as preferential themes by the researchers. Also, the southeastern region was privileged, specially Rio de Janeiro, Brazilian political center until the 1960s. In more recent years, the studies became more diversified, including

multiple themes and different regions of Brazil. Another trend of the studies was the focalization of more remote historical periods. We want to focus also on other perspectives and themes present currently at Brazilian historiography of science.

Historiography, Brazil, Sciences

The Conferências Populares da Glória and the scientific vulgarization in the 19th century Brazil

Maria Rachel de Gomensoro Fróes da Fonseca, Casa de Oswaldo Cruz/Fiocruz

In the 19th century, as Bernadette Bensaude-Vincent highlighted (1993), at the same time was created the term «vulgarisation», hundreds of books, magazines and other publications dedicated to put the science of possession of all, mobilizing all diffusion supportes, such as courses, conferences, magazines, books, encyclopedias, exhibitions and museums. Sought suit the science to all tastes and conditions, so practical, useful, recreational, popular for all, industrial, farmers, women or children. The vulgarizadores sought in its conferences and publications, to communicate their knowledge to the general public, with a view to its dissemination to the general population, primarily the working classes and the children. The vulgarization was seen as a democratic conception of knowledge, science for all, and the conviction of many of these scientists that the growing science represented an instrument for knowledge of new nations in construction or consolidation in that period, to the formation of the people. It is in this perspective we present the Conferências Populares da Glória, so called because they perform in public schools in the parish of Glory, in the municipality of Rio de Janeiro's Court. Began in 11/23/1873 under the initiative and coordination of Manuel Francisco Correia, a senator of the Empire, for which the question of popular instruction was central and the primary function of the conferences was to be a kind of "incessant to awaken the spirit". Were made by intellectuals references in scientific and cultural scene of the time, in order to arouse public interest and educate the population in the most diverse themes and discussions of science, culture and the arts in the country. The conferences marched on, initially, on sunday morning and were routinely announced in advance in the most important newspapers of the time. The agenda addressed included literature, theater, art, history of civilizations, education, and especially to the knowledge of the various intrinsic thematic Science (mathematics, biology, medicine, Botany, astronomy, physical sciences, pharmacy, agriculture). The talks aimed to the dissemination of scientific knowledge, and awareness of the power of ideas and of science in the improvement of society. The Conferências Populares da Glória occurred without major interruptions until 1889, when they were suspended, and resumed in 1891 and continued until 1905, the year of the death of Manoel Francisco Correia.

história da ciência-Brasil; vulgarização da ciência; Conferências Populares da Glória

Histories of Mexican Physical Anthropology: uses and functions of memory

Miguel García Murcia, Escuela Nacional de Antropología e Historia

The Mexican scientific historiography constitutes at the present time a field of academic production solidly constituted, varied and extensive. These features are also a reflection of a long tradition of science promotion in the country, whose intensity was increased from the end of the nineteenth century as a fundamental characteristic of the process of construction of the National State and the consolidation of a political regime, that favored economic progress and social inequality. This period (late nineteenth century and the first decades of the twentieth century) was the scene of

the institutionalization of various scientific disciplines in Mexico, marked by the opening of educational, museum and research spaces financed by the State, the emergence of experts, the creation of theoretical and methodological frameworks, as well as the legal recognition and social validation of disciplinary practices of novel approach, among them physical Anthropology. It is interesting that, from a very early moment also began to be produced historiographical works dedicated to that science. The first of these was the article published by Nicolás León in 1919, "History of Physical Anthropology in Mexico," which was followed throughout the 20th century by numerous references to the history of the same discipline. Most of them are produced by physical anthropologists.

The purpose of this paper is to present possible lines of historiographic analysis for Mexican Physical Anthropology, under the hypothesis that the examination of the histories of this discipline, besides showing diverse perspectives on its historical development, will also allow to observe them as substantial elements in the establishment of union identity links, as well as mechanisms of political and social action that facilitated and shaped the scientific practice, in an environment of institutional and professional pressure in which different scientific fields and governmental interests intervened.

Mexico; Physical Anthropology; history Mexican science; disciplinar historiography

The Construction of a Scientific Tradition and Identity. The Historiography of Pharmaceutical Discipline in the Mexico of the Turn of the Century (XIX-XX)

Ricardo Govantes Morales, Faculty of Higher Studies Acatlán-UNAM

This paper proposes the analysis of some of the first historical interpretations that Mexican pharmacists from the end of the Nineteenth Century and beginning of the Twentieth displayed to account for the development of their discipline in Mexican soil. Some members of the Mexican Pharmaceutical Society carried these out, and they belong to a bigger phenomenon, in which pharmacists of various latitudes ventured into writing their disciplinary memories, which were assumed in some cases as part of the scientific practice of these professionals. The historiographical task allowed these scientists to construct a genealogy for their discipline, fundamentally attached to the establishment of Organic Chemistry that had been greatly developed during the Nineteenth Century, which is why by writing their histories they could contribute in the construction of a scientific tradition and identity for their craftsmanship in local contexts.

The same way as the world's pharmacists searched for the construction of a scientific tradition and identity during the Nineteenth Century, focusing their attention in investigations closer to Organic Chemistry and through histories and chronologies that represented the pharmacological achievements as a succession of progressive triumphs guided towards the development of positive knowledge, the Mexican pharmacists followed suit through the first dissertations related to the scientific memory of their profession on a local level. Such texts were intended to rescue the Mexican scientific past to demonstrate the long tradition of development of knowledge about the therapeutic properties of nature in Mexican soil. But above all, they intended to insist through a positivist interpretation of history on the role that the Nineteenth Century had on the development of a positivist science in Mexico.

History of Science; History of Pharmacy; Mexican Pharmacy; XIX century

096. African Encounters: Making Scientific Knowledge in Africa before and after European Colonization, 1500 to 2000

Sierra Leone as Science Lab: Making Scientific Knowledge in Age of Antislavery, 1770-1800

Eric Herschthal, Columbia University

Historians of science have recently begun to explore the ways slavery shaped scientific knowledge in the eighteenth century. This paper builds upon and critiques this scholarship by exploring three men of science who played a critical role in the founding of Sierra Leone, an antislavery British colony established in 1787. Through the lives of John Fothergill, Henry Smeathman, and Adam Afzelius, I argue that antislavery, not only slavery, was essential to producing scientific knowledge about Africa between 1770 and 1800. John Fothergill, a British abolitionist and naturalist, conceived of Sierra Leone as a colony to combat New World slavery, arguing that paid African labor could work the land and promote several agendas at once: antislavery, commerce, science and empire. Henry Smeathman's expedition to West Africa in the 1770s, funded by Fothergill, not only made Smeathman's scientific career (he published a landmark study on termites based off his voyage); it also enabled him to write some of the region's first natural histories. To read Smeathman's writings is to see up-close how the antislavery agenda influenced scientific ideas about the region. In the 1790s, Adam Afzelius, the colony's first official botanist and a student of Linnaeus, helped Royal Society president Joseph Banks experiment with growing different commodities in the region. Exploring Afzelius' work with Banks, we see the critical if wholly ignored role indigenous African men and women played in producing botanical knowledge.

antislavery, Sierra Leone, natural history

The Entanglements of Imperial Medicine: Episodes from the Gulf of Guinea, 1480-1900

Hugh Cagle, University of Utah

Histories of science and empire tend to portray the colonial adoption of indigenous materia medica as the appropriation of curative materials and the extirpation of social and cultural meaning. My work complicates that familiar story. This paper follows a single item of materia medica over time, as it was swept up into imperial communication systems, crossed empires, and moved into and out of medical regimes. I show how medical meanings—ways of reasoning about medicine and the body—were stickier, more tenacious, more lasting than we tend to think. The plant currently labeled *Crossopteryx febrifuga* first found its way into the European medical imagination at a market in Takrur near the Upper Guinea Coast in the 1480s. Already a staple of materia medica among free and enslaved Africans in the region, it became important as well to Portuguese and Spanish colonial medical practice in the Gulf of Guinea from the sixteenth to the late eighteenth centuries. British interest brought it to the UK's Royal Botanical Gardens at Kew in the middle of the nineteenth century, where dried specimens of it remain today. What did this curative item mean in the context of fifteenth century encounters? In what ways did that meaning change among slaves and settlers on São Tomé (under the Portuguese) or Fernando Pó (under the Spanish)? And what meaning was it invested with when British imperial agents brought it to Kew? No single medical community, and no single empire, ever managed to monopolize the medical meaning of this common tropical plant.

Tropical Medicine; Empire; Colonialism; Indigenous Knowledge; Materia Medica

Local knowledge and cross-cultural medical interaction in Atlantic Africa, 1600–1800

Kalle Kananoja, University of Helsinki

In expanding their operations in Atlantic Africa, European officers and merchants faced heightened mortality and had to deal with the practical challenges of maintaining health and well being in a foreign environment. Attempts to resolve the problems of tropical disease environments included medical interaction with local populations. While cross-cultural medical encounters in Asia and the Americas have been increasingly recognised by historians of science and medicine, Africa is rarely seen as being part of Atlantic scientific networks. This paper examines local medical knowledge in Atlantic Africa in the early modern period by focusing on the Gold Coast and West Central Africa. It argues that Europeans of all nationalities who settled on the coast of Africa relied on African healing specialists to combat tropical diseases. African women were important, and often the primary, providers of this indigenous medicinal knowledge. For the men who lived, and survived, for extended periods in Atlantic Africa, cross-cultural medical exchanges were part of the fabric of their daily lives. In the intellectual order of the era of the transatlantic slavery, however, the contributions of Africans were often deliberately left unacknowledged by the men who sought to systematise medico-botanical knowledge in European centres of learning.

Atlantic world; Africa; health; healing; local knowledge

'It worked for us and the world too': indigenous African metallurgy on the eve of colonization

Shadreck Chirikure, Dept of Archaeology, University of Cape Town

In today's world, Africa's stake in global technological innovation is nowhere near what may be regarded as impressive. Several reasons have been advanced to account for this situation but often, the impact of colonialism is seen as the most significant one. From a total denial of the existence of African technology and innovation, colonialism marginalized many pre-existing technologies not just from academic discourse but also from local problem solving settings. Using the example of indigenous metallurgy, this contribution discusses several elements of African pre-colonial metal production, from mining, through smelting to the distribution and consumption of finished products. It shows that, this technology was associated with numerous context specific innovations that were precipitated by the individual entrepreneurship of the metalworkers. In fact, this technology met the metallurgical demands of the first European visitors from the 15th century onwards. For example, the Portuguese relied on locally produced iron which explorers such as Livingstone later argued, was of a far much better quality than that produced in contemporary Europe. This technology benefitted the Atlantic and Indian Ocean worlds at different points in time. African technological knowhow in metallurgy sustained slave plantation workshops in the US and in regions such as Brazil and Cuba. The main conclusion of this paper is that technologies such as metallurgy must be brought into the main stream and where they can act as formidable examples of the significance of local innovations, grounded in the local situation.

indigenous metallurgy; Africa; global south

097. Whose? Science, Technology, Medicine

"Whose?" A Poem in Creative Defiance

Clapperton Chakanetsa Mavhunga, MIT

In this presentation, which serves as an introduction to the symposium, I will do something unorthodox for a historically trained STS scholar. A poem, dealing with the question of “Whose?” I want to expand it to cover a wide spectrum of our understandings of the world, its condition, its pasts, presents, and aspirations. At core the poem is an invitation to question things, particular those that are called science and technology in a universalistic language, or deemed “Western” even as the itineraries that constituted them are multiple. The task of the poem is to be able to summarize my reading of the two concepts in a way that opens up ways of thinking about them from multiple and diverse locations—spiritually, politically, socially, culturally, economically, geographically, intellectually, and so forth. The goal is not to reject science or technology, but to create a non-colonial or non-othered register and space that frees us to think of what science and technology are unencumbered by the yardsticks irrelevant to our own situations. In a word, a meaning meaningful and purposeful to us, addressing our priorities.

Whose Creative defiance meaning

Whose textile technology history? Guinea cloth - Negro cloth – Indiennes

Geri Augusto, Brown University

The history and geography of textile technologies can be less conventionally told, across Africa, India and the Americas, from the angle of the slave trade and the enslaved Africans who spun, dyed, wove, wore and traded varieties of cotton cloth, forcibly or by choice, under circumstances both free and unfree. From this angle, technologies for manufacturing textiles, and the textiles themselves produced, take on different meanings. One set of meanings flows from the “negro cloth” which impelled New England mills so profitably into the Industrial Age, and branded the bondspersons’ inferiority. Another facet is disclosed by the “guinea cloth” woven in India, shipped to Europe by the various East India companies, and used by slave traders to purchase humans on the Guinea coast for a life of chattel in the West Indies, Brazil, or the U.S. South. Yet another facet of this history may be revealed by studying the textile technologies which for centuries produced homegrown and regionally-traded textiles of intricate design in West and East Africa--creative industries *avant la lettre*--warped by the competition which the slave trade brought in. Just as intriguing are the *traites des negres and indiennes de traite* cloth produced in 19th century France, linking both the slave trade and abolitionism. Neither these technology traditions and systems, nor their products, can be adequately explored by invoking some universal set of meanings about technology, or reiterating the economics of the slave trade. This paper will explore a few specific textile technologies in the period of racial slavery which spanned two oceans. It will do so particularly from the angle of the enslaved, considering them as both Makers and Users. An original art-work recently created by the author will be an object-support to this exploration, as the paper asks: What differing material cultures — subversive and conventional--are bound up in the textile technologies which were the fabric of millions of lives under racial slavery? What debates and reflections can these now-submerged “techno-tales” engender about the technological past? What can the material and embodied practices inherent in guinea cloth, negro cloth and indiennes suggest about both power-in-technology and “property-in-the-person”? And how might all this expand our emerging if tentative responses to the question Whose?

knowledges of the enslaved; history of textile technology; material cultures of slavery; history of African technologies

Science in Construction of Social Image of The Brazilian Black and Implications in Scientific Education of Black Youth

Lázaro Raimundo dos Passos Cunha, Fundação de Amparo à Pesquisa do Estado da Bahia

This work sheds light on the exclusion issue of black Brazilian men and women's from scientific education environments. Hence, it approaches the social impact of this exclusion and builds upon the conflicting relationship between Western science and the "black being," thus showing the role of this science and its historical narratives in the consolidation of racial prejudices and stereotypes. According to this research, these stereotypes impose important barriers to the black youth's educational progress, who is constantly placed in hostile educational environments, imbued with Eurocentric references that render the legacy of African ancestry inferior and invisible – therefore, the official history of sciences has been an important vehicle for these inequities. The search for alternatives to these traditional models of sciences teaching motivated the author to conduct social-action research in the Oguntec program. This initiative seeks to foster interest in sciences among the black youth, and it was developed by Instituto Cultural Steve Biko (ICSB), which is an organization of the black Bahia subjects' movement and a pioneer in Brazil regarding the promotion of university preparatory courses for the black youth. The research exposes an innovative pedagogical experience, interdisciplinary, anti-racism, and consequent proposal of decolonizing knowledge. Behind this pedagogical proposal, we identified actors with strong social involvement, composing the administrative and teaching staff of the Oguntec program. These teachers provided a new meaning to sciences teaching and introduced new references for the content, methodology, and curriculum of sciences courses. Such approach was successful to such an extent that its positive effects were registered in the testimonies and attitudes of the young students who acquired a new stand vis-à-vis the "appalling" areas of science and technology. Therefore, they started to comprehend their entrance at universities in these fields as possible and they have developed a critical perspective about their exclusion in these areas of knowledge.

Such ethnographic research, sought to provide contributions to the debates on public policies for scientific education and to make them more inclusive and compatible with the Brazilian multiracial reality.

scientific education; black youth; eurocentrism; stereotypes; history of sciences

National Sciences: Mosquito-Borne Diseases, Visions of Health, and the Idea of Brazil

Luisa Reis Castro, Massachusetts Institute of Technology

This paper investigates new technologies for controlling mosquito-borne diseases as a window to discuss arrangements between science and public health policies in Brazil. I argue these new technologies being implemented are also a claim of scientific prominence, an ambition to reach global health markets, and an assertion into the capacity to manage and protect human life from growing anxieties about mosquito-borne disease epidemics. By inquiring how visions of "health"—as scientific object, as commodifiable product, and as developmentalist project—are imagined and actualized in the country, I explore attempts to develop different national health sciences that can respond to global economic and scientific imperatives. I do not take for granted that there is one kind of Brazilian science but propose to investigate how institutional settings, scientific practices, and

ICHST
2017

engagements with the natural world are understood and made to be "national". Beneath the unified concern for controlling mosquito-borne diseases, these different national health sciences point to contrasting ideas about what Brazil—and the health of its population—might or should be. I draw from historical analyses of how mosquito eradication has been embroiled in claims and aspirations of modernity in Brazil since the beginning of the 20th century to probe and question the dichotomies between being Western/non-Western, periphery/center.

Health, Science, Mosquito, Brazil

098. Conceptualising Encounters: 'Science' in the South

The Place of Science in Understanding Mission Encounters

Daniel Midena, University of Queensland

This paper contends that notions of 'science' have long been central to making sense of mission encounters. In the 1850s, to take but one well-known example, the Scottish missionary David Livingstone resorted to writing an imagined dialogue between an African 'witchdoctor' and a European 'medical doctor' as a way of making sensible the strangeness of African witchcraft for his mid-nineteenth-century Protestant supporters. For Livingstone, the figure of the European medical expert—a modern man of science—best highlighted just how and why Africans thought and acted so differently from modern European Christians.

Historians, too, have resorted to explaining the tensions (and differences) enacted in mission encounters in the 'South' in terms of radically competing views about nature and knowledge. It is their imagination—of either science in the singular (as something lacking among the 'heathen') or sciences in the plural (as different paradigmatic ways of knowing the world)—that has provided the conceptual basis for historians to study and write about mission encounters as competing ontologies. To this extent, this paper seeks to relate ongoing discussions about the comparative analysis of ontologies (predominantly within anthropology) with research being done by historians on science and mission in colonial contexts.

The first half this paper is essentially historiographical. Beginning with Livingstone, the paper provides an overview of the explicit and implicit function that notions of science played in selected historical accounts of mission encounters, including by Robin Horton, John & Jean Comaroff, Sujit Sivasundaram, Viveiros de Castro and Webb Keane—among others. In the second half of the paper I then provides my own reading of a mission encounter in Anglican medical missionaries in the Solomon Islands. I show how a changing awareness about the nature of diseases in the twentieth century shaped these missionaries' understanding of their evangelical calling. Where historians such as Peter Harrison have claimed that 'the concept of "religion" does the primary work in these processes of secularization', the main contention of this paper is the somewhat complimentary claim that modern conceptions of 'science' did much of the work in both the process of Christian conversion and the representation of the process of conversion in the South Pacific in the early twentieth century.

missionaries; ontology; colonialism; South Pacific; medicine

Archaeological Encounters in Micronesia: Early German-language interpretations of the Nan Madol ceremonial complex in Pohnpei

Hilary Howes, The Australian National University

The ceremonial complex of Nan Madol, a series of more than 100 man-made islets off the coast of Pohnpei, Eastern Micronesia, harbours the remains of monumental stone palaces, temples and tombs. These megalithic structures have long fascinated visitors to the area, including German-speaking traveller-naturalists, anthropologists and colonial administrators in the late nineteenth and early twentieth centuries, whose early descriptions of above-ground surveys and archaeological excavations conducted at Nan Madol are still amongst the most detailed available.

In this paper I examine the investigations and publications of key figures in this German-speaking tradition, including Johann Stanislaus Kubary, Otto Finsch, and Paul Hambruch. I discuss their speculations on the origin, meaning, construction and use of Nan Madol, paying close attention to the kinds of knowledge they drew on to develop and support their conclusions: for example, physical anthropology, material culture studies, and/or local oral traditions. Against the backdrop of their encounters – amicable or antagonistic, extensive or ephemeral – with the indigenous inhabitants of Pohnpei, I interrogate their characterisations of themselves and their indigenous interlocutors, and their comments, if any, on indigenous ways of knowing and being.

Archaeology; Germany; Micronesia; Nan Madol; encounters

Deifying Nature in the "Aztec Encyclopaedia"

Iris Montero, Brown University

Why did the Mexica –or Aztecs– choose a hummingbird, the tiniest avian creature, as their main deity, the solar god Huitzilopochtli? This talk tackles this question through a close reading of an unlikely source, a sixteenth century "encyclopedia". The highly mediated Colonial manuscript from Central Mexico, otherwise known as the Florentine Codex, is three books in one: a Nahuatl narration, its Spanish partial translation, and a visual record of Aztec life before the arrival of Europeans in the form of over 2000 images. Scientists, biologists and physicians primarily, have long emphasized the empirical and material impulse behind the Codex by comparing it to Pliny's *Naturalis Historia* and, indeed, by labeling it an encyclopedia. Meanwhile, art- and ethnohistorians have emphasized its qualities beyond representation and have seen it as a living text, an object where matter and meaning work together and have the potential of rendering it a subject. Focusing on the case of the deification of the hummingbird I offer a third possibility: a reading that emphasizes both the empirical vein of the naturalist tradition of the Mexica and the preeminence of visual thinking for conveying those findings. I contend that through its rich triple discourse, the "Aztec encyclopedia" reveals the centrality of the hummingbird not in the book on deities, but in its cross-referencing with the books on nature.

science, indigenous knowledge, visual thinking, Aztecs, hummingbird

La Tour du Monde: Exploration, Ethnography, and Science in the South

Neil Safier, Brown University

This presentation will explore some of the ethnographic writings of Jean-Baptiste Leschenault de la Tour (1773-1826), with an eye toward understanding the relationship between scientific discourse and indigenous knowledge across a broad swath of southern climes that La Tour visited during an extraordinarily geographically expansive career. Through an invitation to join an expedition that would chart the western coast of New Holland (Australia) in 1800, Leschenault de la Tour became the epitome of the cosmopolitan botanist, hitching rides on ambitious expeditions of scientific curiosity – and occasional botanical looting – as he traveled throughout the South Pacific, Australia, and Southeast Asia. Sponsored by Napoleon, who had famously recognized the paramount value of military officers and scientists traveling together, Nicolas Baudin had been ordered to survey the western coast of Australia with an especial attention to geography and natural history, a marriage of military and scientific purposes that came to exemplify Napoleon's ethos of exploration in the late-eighteenth century. Previously, Baudin had traveled to China, India, and around the tip of Africa, and had been forced due to bad weather all the way to La Trinité (Martinique), where he deposited his not insignificant collection of lives plants, seashells, minerals, insects, fish, and other bounty from his earlier travels. On his Australian voyage several years later, Leschenault accompanied Baudin and his entourage as chief botanist. Leschenault de la Tour's travels took him from Paris not only to Australia, but also to Indonesia, India, and finally to Suriname and French Guyana. Moving across broad spaces and crossing the globe with apparent ease was, in the early nineteenth century, the after-effect of circumnavigations that had made the globe seem to be a far smaller place than even a century before.

Exploration; Ethnography; Botany; Leschenault de la Tour

Europe and its Indies in the 16th century: the missing “South”

Romano Antonella, EHESS - Centre Alexandre Koyré

Europe and its Indies in the 16th century: the missing “South”

The 16th century corresponds to the complex and multi-focused process through which Europe has achieved the “englobment” of the earth. New conceptualizations of the space have been carried out by many types of supports: letters, travelogues, maps, cabinets.

The aim of this paper is to investigate the spatial-and-imagined categories used within these sources and look for a possible definition of the “south”. I will put an abstract category of “south” (and the distinct values and representations associated with it) face to face with the concrete and material operations which shape the maps of both “east” and “west” Indies, as the other continents are often called in this period. The confrontation between these two ways of seeing the world from Europe will reveal two modes of proceeding in knowledge production, one based on the Ancients, the other referring to experiences of displacement and enlargement of the world.

Europe; world; maps; globe

099. Space at Work: Observatories and modern Nation-building since the Nineteenth Century

A prime meridian in the Southern Hemisphere: the scientific network based in Santiago de Chile in the mid-19th century

Amari Peliowski, Universidad de Chile
Catalina Valdés, Independent scholar

In the mid-19th century, Santiago de Chile initiated a process of institutional and infrastructural modernization as well as a transformation of its cultural paradigms, embodied by the founding of the first national university in 1842. The action of local and foreign scientists, who fostered the capital city as a platform for the development of scientific research, was paramount for this process. One of the places where many of these scientists converged was the astronomical observatory located at the summit of Mount Santa Lucia, in the center of the city. Since the passage of the Malaspina Expedition in the late 18th century, the spot had been known as the regional “prime meridian”, nomenclature that was maintained at least until the mid-1870’s. This observatory was set up by the members of the U.S. Naval Astronomical Expedition to the Southern Hemisphere. This expedition, commanded by Lieut. James Melville Gillis, stayed in Chile between the years 1849 and 1852. Gilliss’ climatic, astronomical and geographical observations fostered the incorporation of the young Chilean republic to the great map of modern nations that participated in the mensuration and representation of the world. This proposal looks to explore how Gilliss’ work contributed to the dynamization of the incipient local scientific field: with whom did Gilliss establish scientific or political ties while he prepared his expedition from Washington? How did these ties develop during the years the expedition stayed in Chile, and did they remain after they left the country? How did the exchanges between the members of the expedition with local scientists, politicians and intellectuals determine the nature and scope of their research and of that of others scientists? Through the analysis of official reports, publications in local newspapers and magazines, private correspondence, as also of visual sources, we propose to identify some of the interactions established by the men of science that converged in Santiago in the mid-19th century. Our main goal is to situate the network of scientific actors in the urban scene, in order to reconstruct a social dynamic and a historic moment. This is a period when Santiago projected itself outwards –as a reference point for cartographic measurements as well as for the development of regional science— and inwards –harboring a process of urban modernization and of reconfiguration of national policies in regards to knowledge, exploration, culture and education.

James Melville Gilliss; Santiago de Chile; History of Astronomy; Nineteenth Century; Intellectual History

Celestial Space and Tropical Nature: Emmanuel Liais in Brazil and France

David Aubin, Sorbonne Université / Pierre et Marie Curie

In 1865, the astronomer and meteorologist Emmanuel Liais (1826–1900) published in France a lavishly illustrated book titled *L’Espace céleste et la Nature tropicale: description physique de l’univers* [Celestial Space and Tropical Nature: Physical Description of the Universe]. This work was the second book of Liais edited by the same publishing house, the Garnier Frères. The others books, *Hydrographie du Haut San-Francisco et du Rio das Velhas* (1865), *Traité d’Astronomie appliqué et de géodesie pratique comprenant l’exposé des méthodes suivies dans l’exploration du rio de San-Francisco* (1867), *Climats, géologie, faune et géographie botanique du Brésil* (1872), were in fact reports prepared by the astronomer for the Brazilian government. Since his first arrival in 1858, Liais worked for D. Pedro II, the Emperor of Brazil, in some scientific missions in the Brazilian campos,

aiming the territorial integration of Brazil through its river basin. Besides, he reorganized the Observatory of Rio de Janeiro, in 1874, becoming in this occasion its director.

From the perspective of Brazil, the astronomers, their expeditions and all these textual productions can be viewed as important instruments for its territorial construction. Besides, the presence of foreign scientists and travelers obviously concerns symbolic aspects of this construction, once they produce in Europe a controlled propaganda of the country and its Emperor. From the perspective of Liais, the contents of books as *L'Espace Celeste* implied an improved point of view of the astronomer. The surprising title of the book reflected his conviction that his confrontation with tropical nature was instrumental in shaping his present conception of the physical universe. Among other things, we may emphasize that this experience led Liais to distinguish clearly between mathematical and physical spaces.

In this paper, in collaboration with Rogério Monteiro de Siqueira, from the University of São Paulo, Brazil, we would like to pay close attention to the various concepts of spaces and nature encountered by Liais in France and Brazil. Besides, since *L'Espace Celeste* worked as a “passeur culturel” between France and Brazil, circulating among both professional and amateurs astronomers, we would like to discuss its reception in both countries. Our analysis is based on a study of both cultural representations and practical operations.

Space, Observatory, Popularization, Brazil, France

Bureau des Longitudes, popular astronomy and the foundation of the La Plata's observatory

Marina Rieznik, CONICET-UNQ-UBA

In 1882, in Argentina, the governor of Buenos Aires province and members of France's Bureau of Longitudes fostered one of the international missions that were observing the transit of Venus across the sun. The local government claimed that instruments they used would serve in the founding of an observatory in La Plata. In this talk I stress the interrelationships between the foundation of that observatory and the popular spreading of news about the transit of Venus. The interest is to get into the historical construction of the assumption that claims that there is a clear limit between amateur records and scientific registry. Also we will show that the competitions between observatories were involved in the construction of that limit.

Argentina; Observatory; Bureau des Longitudes; La Plata; Nineteenth Century

The Imperial Observatory of Rio de Janeiro – IORJ: new perspectives of instruments and circulation

Millena Souza Farias, Museu de Astronomia e Ciências Afins

We aim at to discussing some issues related to the scientific instruments of the Imperial Observatory of Rio de Janeiro (IORJ), and the scientific practices that took place in this institution, during the Empire of Brazil period. The IORJ was created by a decree-law of 15 October 1827, signed by José Feliciano Fernandes Pinheiro, the Visconde de São Leopoldo, by interest of the first Emperor of Brazil, D. Pedro I. This institution only initiated its activities in 1846 temporarily situated at a center locality called the Morro do Castelo.

During the decade of 1870, the director of the IORJ, a French astronomer Emmanuel Liais, called to improve the activities of this institution, initiated the acquisition of a new scientific instruments for

astronomical observations and measure activities, specially data related to local time measurement and astrological phenomena like eclipses. Liais was called due to his expertise to be the director of the IORJ but he had to create the observatory structure, buying instruments, recruit human resources, etc. The first inventory of this instruments was published by Liais in the “Annales de L’Observatoire Impérial de Rio de Janeiro”, in 1882, where he made some critical reviews of the situation of this instruments and the storage condition.

The innovation of our interpretation is look for the IORJ activities through the instruments. The previous studies about the IORJ only considered the instruments to situate the institution in the national and international scenario, emphasizing the meteorological activities, the local time measurements and the universal expositions during the XIX and the beginning of the XX century. We would like to seek the instruments by the conditions of choose, buy, storage and circulation presented in the first inventory to establish an institutional identity, giving basis for the recognition of the institution in different the scientific fields.

Observatory; Scientific Instruments ; Circulation; Astronomy; Brazil Empire

Under the Equator: Nation-building and the Quito Observatory (1870 – 1910)

Sabrina Guerra, Universidad San Francisco de Quito

Ana Sevilla, Universidad San Francisco de Quito

Elisa Sevilla, Pontificia Universidad Católica del Ecuador

The Republic of Ecuador is named after its position on the 0° Latitude. Its founding fathers opted for this name in order to avoid conflict between the three dominant regions that composed its territory: Quito, Guayaquil and Cuenca. The name “Ecuador” had also an important connotation in the world of science. In fact, before the Independence movements of the beginning of the 19th century, the “Audiencia de Quito” began to be known in Europe as “las tierras del Ecuador”, or “the lands on the Equator” after the French Academie des Sciences sent a Geodesic Mission to determine the shape of the world by calculating the arc of the meridian at the Equator with the collaboration and escort of two Spanish naval officers.

In an effort to contribute to Universal Science, Ecuadorian President Gabriel García Moreno (1821-1875) launched, under the equinoctial line, an astronomical and meteorological observatory. The president considered that this project would bring great services to science because no other observatory existed at zero latitude at the time. In fact, at the end of the nineteenth century, more than half of the astronomical observatories were located at more than 50 degrees from the Equator. The benefits of looking at the stars under the Equator were enormous: the whole sky was observable and full nights of nine and a half hours with mostly clear skies were present throughout the year. In the next 40 years, the Quito Observatory repeatedly worked in the verification of the calculations made by the French Geodesic Mission, and sponsored the Second French Geodesic Mission in 1901. We will analyze the role of the Quito Observatory in both aiming at Universal science from a specific and peculiar locality such as the Equator, and defining a nation based in its geographical and natural specificities, instead of linguistic or historical particularities as in the case of European nations.

Circulation of knowledge, Jesuit Observatories, Nation-building, South America

100. Renaissance Cosmology and Its Literary Forms: Mediating between Local Experience and Global Perspectives

Giordano Bruno and Lucretius - Infinite universe and infinite worlds

Luiz Carlos Bombassaro, Universidade Federal do Rio Grande do Sul

Pietro Omodeo, MPI WG

Silvina Vidal, UBA

Giordano Bruno represents an exemplary case of the reception of the thought of Lucretius in the Renaissance. However, for a long time and for many readers and interpreters of the Brunian work, the relationship between Bruno and Lucretius was neglected or remained in the background. More recent and accurate studies, however, point out a close relationship between Lucretius's thought and Bruno's work. Bruno's interest in Lucretius permeates all the work of Nolano, from his first Italian dialogues to his later Latin writings, especially "De immenso" (1591). One who investigates the formation of Brunian thought from a historical-conceptual perspective will notice that in the Italian dialogues, Bruno quotes the "De rerum natura" very freely, while in the Latin writings his references to Lucretius are much more precise. As I want to show, the beautiful and seminal poem "De rerum natura" is a basic reference for the Brunian work. In fact, the Lucretian ideas present in Bruno go far beyond the metaphysical and onto-cosmological theses, such as those that refer to atomism, to the infinity of the world and to the infinite worlds. By laying the foundation for a theory of sensibility and human action, they also permeate Bruno's ethical and aesthetic conceptions. Thus the spirit of Lucretius manifests his presence both in the literary style that marks the writings of Bruno and in the disposition of the elements that constitute the own Brunian conception of the philosophical activity, especially when he presents the figure of the philosopher.

Cosmology, Renaissance, Giordano Bruno, Lucretius

The Poetics of Cosmological Instruments: Between experient knowledge and global authority

Maria Avxentevskaya, MPIWG

Poetic depictions of legendary, historical and functional astronomical instruments can be found in abundance in early works on popular mechanics, such as John Wilkins's "Mathematical Magick" (1648) and poetical introductions to treatises on natural philosophy. My paper will consider the poetic representations of astronomical instruments which were engaged both in observations and in theoretical apprehension. I will explore how the poetics of instruments mediated between the individual experient knowledge of "doing cosmology" and global cosmological knowledge. I will argue that poetry as a literary form not only helped propagate the use of instruments and cosmological constructs, but also played a heuristic role by translating the data obtained from instruments into aesthetically appealing and operable models of the cosmos – a phenomenon not entirely unparalleled in our modern cosmology. Ultimately, in the example of early-modern astronomy, my study will attempt to outline the factors behind "poetic authority" – the rhetorical, social, and political significance of poetic depictions in the dissemination and implementation of knowledge about nature.

Cosmology, poetics, experience, authority

Lunar maps and Cosmological Narratives in the Seventeenth-century

Nydia Pineda De Avila, Queen Mary University of London

This paper enquires into the connections between cosmological narratives and the practice of lunar mapping in the seventeenth-century. The classical and humanist topos of the Earth-Moon analogy and of the cosmic voyage provided astronomers with an interpretative framework and a vocabulary for the translation of the experience of observation into a verbal argument. These notions also influenced the construction of surveys of the moon made with the telescope: selenographies were not merely astronomical instruments supplementing methods for the calculation of longitude and other celestial phenomena but were also graphical devices that illustrated the travelling of the human gaze and understanding through space. This presentation will show ways in which authors of maps of the moon, such as Pierre Gassendi (1592-1655), Michael Van Langren (1598-1675), Johannes Hevelius (1611-1687) Robert Hooke (1635-1703), appropriated cosmological narratives into their lunar descriptions and graphical experimentations. Conversely, I will argue that selenographers such as Jean Dominique Cassini (1625-1712) also contrived cosmological views in a poetic form informed by astronomical practice. Through these cases I will demonstrate that the use of cosmological metaphors related to the global perspective of a planet are strongly connected to local experiences, practices, and audiences.

lunar maps; cosmic-voyage; earth-moon analogy

Galileo Galilei's Cosmological Dialogue in the Literary Context of the Renaissance

Pietro Daniel Omodeo, Max Planck Institute for the History of Science

Galileo Galilei's cosmological dialogue, *Dialogo sopra i due massimi sistemi del mondo* (Florence 1632) stands out, in Renaissance scientific culture, not only as one of the most significant discussions of the Copernican theory and its physical and philosophical implications but also as a literary masterwork of the time. The use of the dialogical form permitted Galileo to openly discuss arguments pro and contra terrestrial motion and heliocentrism in fashion that was at the same time instructive and pleasant. His work thus met a classical requirement for literary accomplishment. At once, Galileo believed that dialogical openness could avoid the censure that had stroke Copernican astronomy in 1616. Galileo made frequent use of rhetorical means in order to present controversial and theologically loaded issues. For instance, he often presented cosmological and cosmogonic views as 'fables', just like Descartes in the almost contemporary tract *Le Monde*. As far as the genre of Galileo's Copernican work is concerned, this has to be compared to other literary works presenting cosmology in a similar literary manner. Among others, it is expedient to consider the philosophical dialogues by Nicholas Cusanus and by Giordano Bruno, especially the latter's apology for Copernicus in the *Cena de le Ceneri* (London 1584). Cosmological dialogues bringing together a reflection on cosmology, satiric mood, and linguistic freedom widely circulated during the Renaissance, for instance the Venetian poligraph Anton Francesco Doni's *I Marmi e Mondi* published in Venice in the 1550s. Besides these works, one source deserves particular attention as a literary anticipation of Galileo, Girolamo Borri's *Del flusso, et refluxo del mare* (Florence 1577) dealing with sea tides in a cosmology frame stilistically akin to the treatment of the same topic in the forth day of the *Dialogo*.

Galileo Galilei; Renaissance Literature; Cosmology

Literally sources of Walseemüller's cosmography and its relation with copernicanism

Silvina Paula Vidal, Universidad Nacional de San Martín

Marcelo Leonardo Levinas, Universidad Nacional de Buenos Aires, FFyL

In this paper we propose a series of hypothesis on Martin Waldseemüller's enigmatic cartographic representations of 1507, highlighting the connections between his cosmography and Copernican cosmology. Not much is known about Waldseemüller life and career: he studied at the University of Freiburg in 1490, and belonged to a group of humanist scholars (Matthias Ringmann, Gauthier Ludd), which related to cathedral school of St. Die, worked under the patronage of Duke René II of Lorraine. By looking carefully at Waldseemüller's cartographic representations and the cosmographical treaty (the *Cosmographia introductio*) that accompanies them, we will examine how this German cartographer, assisted by Ringmann, elaborates a hybrid image of the world, employing a variety of different literary sources from Homer and Virgil, to Pomponius Mela, Henricus Martellus, the travels of Marco Polo and the more recent accounts of Americo Vespucci.

Special attention will be given to the role that a peculiar reading of Vespucci's accounts played in the conceptualization of America as a "fourth part" of the world. The process implied a thorough review of the philosophical speculations on the tradition related to the characteristics of the Earth. By covering 360° degrees, Waldseemüller world map doubled the Ptolemaic representation and encouraged the re-examination of the measurements of both the Earth and the universe. In turn, this strengthened the widespread idea of earth movement; two key issues in the history and development of Modern science. Furthermore, exploring the intersections between the work of Waldseemüller and Copernicus, will allow us to consider the typical achievements and contradictions of Renaissance science, to argue their peculiar way of understanding the discovery of new lands, and to determine the consequences of how information was processed.

Waldseemüller; Copernicus; cosmography; America; Renaissance science

101. The History of Soviet Biology: The Domestic, Local and Inter-societal Problems

The Lysenko Period as seen by Russia's Biology Teachers: Another Hard Time and Another History of Russian Biology

Hirofumi Saito, Tokyo Institute of Technology

Trofim Denisovich Lysenko's monopoly of Soviet biological and agricultural sciences began in August 1948, when Mendel-Morgan genetics was abolished in the general session of the All-Union Academy of Agricultural Sciences, and lasted until 1965, when Lysenko lost the directorship of the Institute of Genetics. During this period Soviet biological sciences, and especially genetics, suffered poor conditions in both research and education. Numerous historical studies have investigated this period, elucidating how Lysenko began his professional career among elite Soviet biologists in the 1930s and how he established and maintained his powerful position, effectively ruling Soviet biology until 1965. However, insufficient attention has been paid to the situation in the recovery period after Lysenko's downfall in 1965. Because the range of Lysenko's influence was not limited to genetics research and agriculture, but reached into the broad realms of Soviet social life, various approaches to the problem of recovery can be taken. One realm worth examining is the status of biology education before and after 1965. The transfer of accurate knowledge of biology to Russian students had been frustrated since 1948. This talk elucidates an initial part of the recovery process by focusing on the situation during the years immediately following Lysenko's downfall, treating separately the situations in institutes of higher education and in secondary schools. Generally speaking, as

compared with institutions of higher learning, the reform of biology instruction for secondary education went through a more complex process because it was overseen by higher levels in the administrative hierarchy. Secondary education reforms had to receive official approval for such efforts as the creation of a new biology course program and common educational materials, and required re-training of thousands of school teachers.

Soviet Russia Biology Education Lysenko

Pages from the History of the Institute of General Genetics of the USSR Academy of Sciences (from the second half of the 1960s through the beginning of the 1980s)

Sergey Shalimov, St. Petersburg Branch of the Vavilov Institute for the History of Science and Technology, Russian Academy of Sciences

The history of Soviet genetics is of a great interest for Russian and foreign researchers. At the same time, the development of “disgraced” science in the “post-Lysenko” epoch is studied much less in comparison to the previous period. In particular, the history of the big center of genetics, the Institute of General Genetics of the USSR Academy of Sciences (now – the Vavilov Institute of General Genetics of the Russian Academy of Sciences), is still insufficiently researched. The bright personality of one of the leading Soviet biologists and the first director of the Institute academician Nikolai Dubinin (1907–1998) adds more interest to the topic.

As is known, the famous decree of the USSR Academy of Sciences “On the development of genetic research in the Academy of Sciences”, dated 25 December 1964 included many measures aimed at the revival of genetics. The first point was the organization of the Institute of General Genetics, which was founded in April 15, 1966. According to archival documents, the administration of the Academy of Sciences wanted this Institute to be the main genetic center in the USSR.

One of the Institute’s fundamental problems during the early stage was the lack of material support. Specifically, the development of research was hindered by the short supply of equipment and chemical reagents. Also, the Institute didn’t have an adequate experimental base, and till 1977 there was no modern building for the laboratories. Nevertheless, in the second half of the 1960s the documents of the Presidium of the USSR AS referred to the Institute “a large-scale scientific institution for the research of problems of general genetics” and underlined the practical achievements of geneticists.

The situation in the Institute of General Genetics was especially aggravated in late 1970s – early 1980s. It was then that the Institute began to receive negative evaluation in the documents of the Academy of Sciences. The main reasons were problems with the staff, various conflicts and ambitions of N. Dubinin, who remained in opposition to his colleagues in the Institute and other leading Soviet geneticists. As a result, the Institute did not achieve the “required” level of research and did not become the leading research center in genetics.

Acknowledgment: The research project was supported by the Russian Foundation for the Humanities, grant no. 15-33-01225.

genetics, the history of genetics, Lysenkoism, Dubinin, the Soviet Union

102. Evolution and Heredity in Motion: Communication, Dissemination and Reinterpretation

The History and Geography of Lloyd Morgan's Canon

Evan Arnet, Indiana University Bloomington

Conwy Lloyd Morgan's Canon stating, "In no case may we interpret an action as the outcome of a higher psychological faculty, if it can be interpreted as the outcome of the exercise of one that stands lower in the psychological scale," has achieved near mythic status within the history of comparative psychology. It has been appealed to, attacked, critiqued, refined, and above all, endlessly interpreted and reinterpreted. While I do provide a brief analysis of the canon, the central aim here is instead to document its journey: beginning with its origination in the work of Lloyd Morgan, following it across the Atlantic into early American comparative psychology, and then tracking its mass dissemination as part of psychological pedagogy. Its story shows not only how each immediate context bled into the interpretation of the canon, but also how the canon carried its history with it. At times, its inertia left the canon being appealed to as a methodological dictum even when the backing conceptual framework in which it made sense had fallen away. I conclude by dipping into historical epistemology and tentatively deriving an Aesop. The history of the canon, I contend, is a gentle rebuke of the recent emphasis on the local and reminds us of the fractured and distributed (over time, space, and institutions) nature of our epistemology.

Morgan's Canon; historical epistemology; comparative psychology; Lloyd Morgan; Thorndike

Social Darwinism in Motion

Gregory Radick, University of Leeds

There are many well-known historical and historiographic problems associated with the vexed topic of "social Darwinism." In this talk I want to explore the promise of a trans-national perspective to illuminate, and maybe even to eliminate, at least some of these problems. Two kinds of trans-national perspective in particular will be considered in detail. The first involves trying to identify a single "big picture" historical trajectory which, for explicable reasons, takes nationally variable forms. The other involves tracking the spoor of particular ideas and texts as they travel from nation to nation, stimulating diverse responses which themselves are then set in international motion.

social Darwinism; transnational history; Herbert Spencer; Peter Kropotkin

Darwin and the Evolution of Dance in The Descent of Man and The Expression of Emotions in Man and Animals

Kate Grauvogel, Indiana University - Bloomington

I am seeking a Darwinian account of the evolution of dance. Reading *Descent* (1871) and *Expression* (1872) together, I am finding such an account in Darwin's remarks about movement, gesture, communication, and musicality. In *Descent*, these elements of dance are generally courtship rituals and

displays, like the show of beautiful plumage in male birds and the rhythmic tapping movements of crabs, and they pay off evolutionarily in terms of sexual selection. In Expression, Darwin explores whether or not there is more to ornamentation and movement than just attracting a mate, and finds survival value in the communication of needs and emotions in both humans and animals. I hope to show that the evolutionary origins of the arts and culture are not all in sexual selection and courtship.

Darwin; Dance; Evolution; Movement; Expression

Which concept of heredity? Unity and disunity in Jacob's and Monod's work

Laurent Loison, CNRS, IHPST

The work of François Jacob and Jacques Monod was pivotal in the development of the concept/metaphor of the genetic program. Their famous 1961 paper in the Journal of Molecular Biology introduced this concept the same year Ernst Mayr proposed his own account in his text "Cause and Effect in Biology". The concept of genetic program represents biological inheritance and development in precise terms: heredity consists in a transfer of information, whereas development is best conceived as the mechanical consequence of the molecular expression of this information. These two closely related ideas had indisputable normative influence on the way biologists thought about heredity and development during the last third of the 20th century and became the standard view in biology.

The aim of this presentation is to show that, despite the success of the concept of genetic program, Jacob's and Monod's understandings of heredity were much more diverse. For Jacob, this pluralism of senses was clear during the 1950s, when he first worked on the induction of the prophage and on bacterial sexuality in close collaboration with Elie Wollman. It was only after 1961 that he devoted himself to a consistent account of heredity in terms of genetic program, especially in his 1970 book The Logic of Life. For Monod, things are even more puzzling because of his almost complete lack of interest for this concept even after 1961. For instance, in Chance and Necessity, Monod never mentions it at all. Based on the careful study of published and unpublished sources, this presentation will precisely reconstruct the various forms of heredity at work in their writings and practices from the late 1940s to the 1970s and will raise the issue of the possible significance of this disunity.

François Jacob; Jacques Monod; Genetic program; Heredity

'Neo-Lamarckism' in the early 20th century: the midwife toad controversy revisited (1913-1926)

Lilian Al-Chueyr Pereira Martins, University of São Paulo

From the beginning of the 20th century the Austrian zoologist Paul Kammerer (1880-1926) performed experiments with amphibians in which he found evidence for the inheritance of acquired characteristics. He claimed to have produced heritable nuptial pads in the midwife toad (*Alytes obstetricans*) which normally lacks. Besides that, the crossings between normal and abnormal forms followed Mendel's laws. Due to their relevance not only to the evolutionary process, but also to heredity, they attracted the attention of the scientific community of that time causing a controversy. Such a controversy involved Kammerer, William Bateson (1861-1926) and other scientists.

The aim of this presentation is to elucidate the epistemic and non-epistemic factors which could have contributed to Bateson's attitude towards this issue. Since 1913 he stated that although Kammerer's experiments had not been confirmed, they deserved respectfully attention. Among the reasons which led Bateson to postpone his conclusions were: the way in which Kammerer performed his

experiments, without keeping the modified specimens as important pieces of evidence; the questionable quality of the photographs and drawings depicted in his publications; the way in which Kammerer reported the results of his experiments; the absence of a specimen to be examined until 1923; and the conditions of such specimen. Later, the fact that the only modified specimen available lacked all traces of nuptial pads stressed his position. Moreover, Bateson was against scientific popularization and Kammerer had attracted wide publicity during his tours in Britain and America. The publication of some results of Kammerer's experiments related to the inheritance of acquired characteristics in text-books before they were confirmed also annoyed Bateson. Since some biologists who followed different lines of research such as Ernest William MacBride (1866-1940) were convinced with Kammerer's experiments, the discussion also involved a struggle for the authority in the fields of heredity and evolution.

inheritance of acquired characteristics; Kammerer, Paul; Bateson, William; experiments; amphibians

Andean Adventures in Bioprospecting: Luther Burbank, José Husbands, and the Boundaries of Botany

Luis Campos, University of New Mexico

This paper explores the horticultural, commercial, epistolary, and personal dimensions of Luther Burbank's bioprospecting adventures in the Andes, which were conducted primarily with the assistance of José Husbands, a talented Chilean botanical collector. While diplomatic channels were one way that horticultural knowledge was often exported northward for commercial gain (Husbands transmitted several important horticultural discoveries to US experiment stations through the US consul), a newly discovered cache of letters more clearly reveals the central role Husbands played in Burbank's own expanding economic empire of botanical novelties. Husbands' incredibly detailed missives, written in the midst of navigating field and mountain, tell a great deal not only about the very real difficulties of Andean bioprospecting and the ways that solitary collecting practices intersected with local folk knowledges, but disclose profoundly personal dimensions as well. Even as Husbands brought significant new species to Burbank's attention, his distinctively flowery and often deeply intimate personal letters illustrate a complex and deeply personal relationship that emerged between the collector and his transcontinental interlocutor and patron. As they bioprospected at the boundaries of botany, their correspondence served both scientific and economic goals, even as it tested the limits of acceptable familiarity. Both professional and personal dimensions of conducting botany thus proved vital to Burbank's successes in importing South American horticultural species for North American economic gain.

botany bioprospecting genetics

"From the Local to the Global: Women Science Activists, Maternalism, and Heredity and Evolution in the Atomic Age"

Marsha Richmond, Wayne State University

Post-World War II debates about the social implications of Atomic Age science were joined by geneticists, who attempted to communicate and disseminate information about both the hereditary and evolutionary consequences of human exposure to radiation, nuclear fallout, and a new breed of synthetic chemicals. Although scholars of post-World War II scientific activism have focused almost exclusively on males, women also served as effective public scientists. This paper examines two

women trained in genetics who came forward in the 1950s and 1960s to educate the public about the dangers radiation and wartime chemicals posed to the human germ plasm. In *Genetics in the Atomic Age* (1956), Charlotte Auerbach (1899-1994) provided a basic understanding of mutation to explain why radiation-induced germ cell mutations were harmful. Six years later, Rachel Carson (1907-1964) drew on genetics in *Silent Spring* to warn that DDT and other pesticides might be mutagens that caused cancer and other health problems. In contrast to male geneticists, they aimed to educate, not lecture the public. They also used gender strategically: in expanding immediate parental concerns to address the well-being of future generations, gaining the public's trust, and as a persuasive rhetorical strategy to encourage public advocacy. Ultimately Auerbach and Carson promoted a new kind of "environmental citizenship," in which a more scientifically literate citizenry was better equipped to challenge oligarchical postwar science policies in the UK and the US.

Atomic Age; Genetics; Heredity; Evolution; Women

Mendel to Tschermak: Dissemination and Appropriation of a Classic Paper

Sander Gliboff, Indiana University

Erich Tschermak (1871–1962, aka Erich von Tschermak-Seysenegg) is considered—usually, but not universally—one of the three “co-rediscoverers” of Gregor Mendel’s famous paper, and a founder of the new science of genetics.

In this talk, I ask in what sense Mendel was “lost” and “rediscovered,” and how the meaning of his paper changed in the process, particularly as it was used and interpreted by Tschermak. To him it had much more to say about agriculture, eugenics, and politics than about either theoretical matters or the physical basis of heredity. In his hands, it also became an instrument for self-promotion in the shifting contexts of the Austro-Hungarian Empire, Austrian First Republic, and Nazi and Postwar periods. In short, Tschermak did not find the same things in Mendel’s paper as the other rediscoverers or early Mendelians, which is perhaps why he does not always get the same credit. This analysis suggests a view of the rediscovery not as a single event, but as a series of new readings of the older text and applications to twentieth-century problems.

Mendel; Rediscovery; Tschermak; Genetics; Austria

103. Organisms From Here To There: Exploring the Effects of the Local and of Place on Research with Organisms

From Atlantic to Pacific: Francis Schmitt, Axon Biophysics, and the Hunt for Squid in Woods Hole and Montemar, 1950-1970

Kathryn Maxson Jones, Princeton University

From the 1940s through the 1960s, Francis Schmitt, the first Biology chair at MIT, maintained a continuous research program on the biochemical mechanisms and physical structures underlying the nervous impulse. These interests emerged especially after J.Z. Young introduced him to the squid giant axon at the MBL in 1936. From then on, Schmitt interrogated the nervous system almost entirely through marine invertebrates, especially squid and lobster. Why did he choose these organisms? How did they affect his conclusions? And how might invertebrate work have influenced his founding of the pioneering Neurosciences Research Program (NRP) in 1961? This paper will argue that place mattered in Schmitt’s career, both practically and theoretically. One reason Schmitt

focused on marine invertebrates was abundance. At the MBL, squids and lobsters proved generally easy to catch. This, in turn, allowed for a wide range of experiments. Electrophysiology on living nerves was done on site, with dissections taking place immediately. Biochemical assays were conducted inshore, with large quantities of nerve extracts shipped to MIT for amino acid content and other analyses. Sometimes, however, this ease of procurement failed, sending Schmitt scurrying to learn more natural history. In the late-1950s he founded a laboratory in Montemar, Chile. The Humboldt squid, with nerve cells much larger than the Atlantic squid *Loligo pealeii*, frequented the waters off the Chilean coast. More material meant more repeatable experimentation, even as distance exaggerated the differences between research performed on-site and that done back at MIT. As the migratory patterns of the Humboldt squid changed, moreover, Schmitt's deputies in Chile were forced into comparative studies, as they were at the MBL when *Loligo* proved elusive. The NRP was an ambitious attempt to unravel the vertebrate brain, from biological foundations to consciousness. I will conclude by suggesting that Schmitt's invertebrate research was integral to the NRP's founding. Macromolecular assemblies in salt water spurred Schmitt's interest in complex properties, like memory, that might emerge from simple chemical systems. Schmitt's comparative studies also alerted him to the biological conditions likely shared by all life, as well as those only shared by some. This convinced him that general physiology, even in squids, could inform human biology, but also that vertebrate research required top-down and bottom-up approaches.

Francis Otto Schmitt; MIT; MBL; squids; Neurosciences Research Program

Generalising from the Local: The Role of Indigenous Animals in Contemporary Australian Research and Practice

Rachel A. Ankeny, University of Adelaide

This paper comparatively tracks the evolution of 20th century research programs focused on distinctive Australian animals, including kangaroos, koalas, bettongs, Tasmanian devils, dugongs, echidnas, and platypuses, with particular attention to how these more atypical or unusual species have come to be used as model systems in the early 21st century in fields. It contrasts the use of various species in different biological fields, ranging from genomics to virology, wildlife health, and animal behaviour, and shows how tradeoffs between typicality and uniqueness have been utilised, with particular attention to how generalisations are made from these species to other types of experimental systems.

Experimental organisms; indigenous animals; biological practices

104. Knowledge in Transfer and Transformation: The Earth and Natural Sciences between Localism and Globalization

Globalizing Earthquake Knowledge. Translation and Circulation of Japanese Seismology in the First Decades of the 20th Century

Julia Mariko Jacoby, Max Planck Inst. for the History of Science / Albert Ludwigs University Freiburg

Translating knowledge cannot be understood as a simple transmission of knowledge into other countries or languages. Rather, it is an active process of carefully selecting and adapting knowledge to actual local customs and needs. This paper traces the translation and transfer of earthquake

knowledge produced in Japan and by Japanese scientists to a global scientific audience, as shown by translated articles of Japanese scholars and summaries by Western scholars.

Seismology as a science operates on both global and local levels. Measuring earthquakes requires globally connected stations and cooperation as well as field work in the affected areas. Seismology itself developed following a global encounter: British scientists constructed the first modern Seismograph 1880 reacting to a highly seismic locality new to them – Japan. Being situated on the “Ring of Fire” and regularly struck by violent earthquakes, Japan became the laboratory for the first seismological measuring network that was soon extended on a global level.

Around 1900, after 30 years of Japanese struggle for modernisation and international acceptance, Japanese Seismologists like Omori Fusakichi had already become acknowledged pioneers in their fields – earlier than in other scientific disciplines. They did fieldwork on a global level and were highly respected experts in other earthquake countries. The core of their research remained nonetheless connected with local interests – earthquake prediction and earthquake-proof construction.

This presentation focuses on following questions: What types of knowledge were selected for translation and regarded as suitable for a global modern scientific community? Was traditional Japanese knowledge, which was indeed scientifically examined, included? What knowledge did they draw from other earthquake-prone localities? On the other hand, did the adopting process of Japanese knowledge differ in earthquake and non-earthquake countries? As such, this paper tries to enlighten mechanisms of globalization and knowledge transfer processes originating from non-Western countries.

seismology; global knowledge; local knowledge; knowledge transfer; Japan

Auguste de Saint-Hilaire (1779-1853): publishing in France on Brazilian nature

Lorelai Kury, Casa de Oswaldo Cruz/Fiocruz

This paper analyzes Saint-Hilaire’s published writings about Brazil and identifies the types of facts he used and how he went about producing his material. He relied on his herbarium and field notes as a central source of information, but oral communications and texts were likewise essential. He had access both to travel narratives about Brazil written by Europeans and to articles and books published by Brazilians. His own travels throughout Europe and his contact with Brazilians in France played an important role as well. The French government and Emperor Pedro II helped fund the publication of some of his books. His strategies of publication were aimed more at Brazilian readers than at Europeans.

The naturalists who visited and then wrote about Brazil cited and critiqued each other’s texts, engaging in dialogue, criticism, cooperation, and competition. This set of texts produced a kind of knowledge that was cumulative and criticizable. Consonant with the descriptive statistics that flourished from the turn of the 18th to the 19th centuries, authors like Saint-Hilaire sought precision in their historical narratives. In the travel books that he published starting in 1830, Saint-Hilaire criticized Wied-Neuwied for committing many inaccuracies, and the German published his rejoinder in 1850. This minor controversy between the two men within the Republic of Letters shows how the information contained in travel accounts was in a way verifiable.

The work that these travelers did on site represented only one stage in the development of their writings. After their trips, it was vital that they consult books, articles, and manuscripts, exchange correspondence, and make verbal inquiries to ensure that they precisely and accurately transcribed names, situated collection sites, and described roads, plant uses, and typical local procedures and customs. It is likely, albeit not well documented, that Saint-Hilaire found the participation of Brazilians valuable during this phase.

A travel account is therefore not a faithful mirror of what is experienced but rather a painstakingly constructed artifact. Analyzing the elements that came into play during the production of these accounts helps us understand how information on Brazil circulated and was incorporated in Europe.

Drawing in the field: Richard Spruce in the Amazon

Luciana Martins, Birkbeck, University of London

This paper will focus on the field sketches of British botanist Richard Spruce, who spent 15 years (1849-64) travelling and collecting herbarium specimens and ethnobotanical artefacts in the Amazon and the Andes, most now held at the Royal Botanic Gardens, Kew and the British Museum in London. In this paper I will examine a notable collection of drawings of indigenous peoples and landscapes by Spruce now held at the Royal Society, as a way of considering the epistemology and practice of field sketching in natural history in the era of early photography. This paper will explore the uses of visual technologies in the field, including their role in cross-cultural exchanges and encounters in the making of nineteenth-century science.

natural history; drawing; fieldwork; Richard Spruce; Amazon

Ignaz von Olfers and Friedrich Sellow: diplomacy and natural history in Rio de Janeiro during the early nineteenth century

Miriam Junghans, Casa de Oswaldo Cruz/Fiocruz

The creation of scientific sociability networks between Europe and Brazil in the early nineteenth century counted with the participation of several foreign diplomats, who combined their interest in natural history to their actuations in official positions. Such was the case of Ignaz von Olfers, secretary of the Prussian Legation in Rio de Janeiro, who embarked on a naturalistic journey to Minas Gerais and São Paulo between 1818-1819 alongside the also Prussian Friedrich Sellow.

This paper analyses the process of choosing Sellow as naturalist traveler at the service of the Prussian government, through the letters exchanged between Olfers, Alexander von Humboldt, Martin Lichtenstein, director of the then newly founded Berlin Zoological Museum, and the Prussian minister Karl zum Altenstein.

The prominent position occupied by natural history becomes patent in the relations between foreign diplomatic representatives in Brazil and prominent politicians and scientists in Europe. Conversely, one may also note the importance of other relationship networks, such as political and official circles, in shaping the scientific sociability networks of the period.

Natural History; scientific networks; diplomacy and Natural History; Friedrich Sellow; Ignaz von Olfers

Between the local and the global. The circulation of knowledge in Mining Education (1850-1900)

Nele-Hendrikje Lehmann, TU Bergakademie Freiberg

Due to the economic crisis after the Seven Years' War new scientific institutions like the Mining Academy in Freiberg (Saxony) were founded. As their purpose was the formation of mining officials for the state's mining administration, they should impart a "useful knowledge", which was often based on

local phenomena and local technologies. Nevertheless, the Freiberg Mining Academy attracted many foreign students and stimulated the foundation of similar institutions all over the world. Following the approach of an "entangled history", the paper focuses on the interdependencies between the institutions of mining education in Germany and the U.S. First, it will discuss the circulation, adoption and transformation of teaching models in mining and metallurgy. Subsequently, it will show how this transfer processes altered the ways of knowing in disciplines like ferrous metallurgy.

Mining Local knowledge Cirulation of knowledge Earth Sciences

105. Global maps, local agents: production and circulation of knowledge in cartographical projects during the first half of 20th Century

The riverhead of the Uruguay River: origins of a controversy

Ana Cristina da Rocha Bérenger Resende, IBGE

Claudio João Barreto dos Santos, IBGE

Márcia de Almeida Mathias, IBGE

The standardization of the names of rivers is one of the most critical issues in the field of Geographic Names in Brazil, once the country lacks a national authority directly responsible for the standardization of the denominations of these geographic features and their springs. In addition, as rivers often demarcate the boundaries between territories and/or countries, their names are likely to vary along the years, since the action of naming is closely linked to issues of political power. In some cases, the geographic name is the crucial factor in accurately establishing the spring of a river. This is the case of one of the most important rivers in the south of Brazil: the Uruguay River, which constitutes the boundary between two Brazilian States and between Brazil and two countries: Argentina and Uruguay. In the past, this region of boundaries was the cause of intense territorial disputes, both within national and international scope. The present piece of research is being carried out by the Brazilian Institute of Geography and Statistics (IBGE) and aims at establishing, drawing mainly from historical cartographic documents, the exact point to be considered the riverhead of the Uruguai River, which could be located either in the confluence of "Pelotas River" with the "Canoas River" or with the "Peixe River", in order to accurately represent it in the Brazilian official cartographic mapping.

geographical names; Uruguay River; standardization of geographical names

A chart of the Province of Rio de Janeiro: analyzing French Navy travellers during the first half of the 19th Century

Daniel Dutra Coelho Braga, Universidade Federal do Rio de Janeiro

In 1824, the French Navy officer Louis de Freycinet, who commanded a scientific expedition around the world between 1817 and 1820, concluded a chart of the province of Rio de Janeiro. Such chart was the result of many different scientific efforts, mainly those carried out by Albin Roussin, another French Navy Officer who had also leaded his own scientific expedition in order to improve hydrographic charts concerning South America.

This paper aims at analyzing to which extent this chart was also a result of the French navy colonial, political and scientific guidelines, which were reconceived during the French Bourbon Restoration. In order to do so, the scientific expeditions carried out by the French Navy are analyzed, as well as the

social trajectories of those travellers. This analyse is based upon the archives under the Service Historique de la Défense, in Vincennes, which allows us to analyse scientific instruments and procedures which were used during the expeditions and might therefore have had influenced the creation of the chart of Rio de Janeiro. Moreover, political negotiations concerning conditions of sponsorship for the expedition are also analysed, since they may have also have influenced the possibilities under which this chart was conceived.

scientific expeditions; French Navy; cartography

Cartography and historical experience in the Empire of Brazil

Leandro Macedo Janke, Museu de Astronomia - MAST

The construction of the Brazilian Imperial State was subject to the hard, albeit necessary, association between the concepts of Empire of Brazil and of Brazilian Nation. During this process, the territory, which was conceived as national by the imperial political heads, was constantly used in their actions of legitimizing and organizing politically and administratively the State which was being formed. This paper has the goal of analyzing two cartographical representations of the territory of the Empire of Brazil and the relations that have been established between both of them and their socio-political context. By highlighting the inseparable relation between map and context, the maps that will be analyzed represent distinct moments of the Brazilian imperial experience. The first of them is the Chart of Brazil and Limitrophe Countries attached to the Memorial Orgânico (Organic Memorial), published by Francisco Adolfo de Varnhagen between 1849 and 1851. The second is the General Chart of the Empire of Brazil in 1873, produced by Duarte da Ponte Ribeiro.

Empire of Brazil; Brazilian Nation; Cartography; Territory; Territoriality

Mapping sertões: the history of the Charter of Mato Grosso (1910-1952)

Maria Gabriela Bernardino, FIOCRUZ

This research contexts surrounding the making of the map of the Brazilian state of Mato Grosso undertaken as part of Cândido Mariano da Silva Rondon's famous journeys of exploration into the hinterlands of Brazil in the first decades of the twentieth century. From 1910 to 1952, this map – of what was an enormous and largely uncharted expanse of backlands Brazil – was minutely designed and researched by the military geographer Francisco Jaguaribe Gomes de Mattos (1881-1974), who was the head and chief of the geography division of the Rondon Commission. The map of Mato Grosso designed by Jaguaribe was a crucial document for the constitution of the geography of the current center-west and became one of the most important propaganda pieces of the Rondon commission itself. In this research I traced Jaguaribe's trajectory from his initial engagement with the Rondon commission to the perfection of the map in Paris from 1924 to 1930. For this congress, I seek to narrate the unknown and unique saga of the fabrication of the map of Mato Grosso; An enterprise that absorbed the geographer Jaguaribe for decades and earned him recognition as both a cartographer of the greatest importance and also placed him as a relevant contributor in the processes of national integration undertaken during the first decades of the twentieth century.

Francisco Jaguaribe; Comissão Rondon; Charter of Mato Grosso

ICHST
2017

Historical cartography in the early years of the Brazilian Republic: geodesy class in Military School

Moema de Rezende Vergara, Museum of Astronomy and Related Sciences (MAST)

The field of historical cartography in Brazil focuses largely on the colonial and imperial periods. Thus, a gap exists in the production of the first years of the Brazilian Republic, proclaimed in 1889. One hypothesis for this lack of attention can be given by the appearances of these maps, already stripped of allegories and iconographic representations observed in maps of other periods.

In this sense, the present essay tries to advance in the understanding of cartography in the passage from the 19th century to the 20th. For this, we analyze the geodesy classes given by the astronomer Luiz Cruls, in the Military School in 1899, that is, ten years after the proclamation of Republic.

It should be remembered that the Brazilian Republic was made by the military dissatisfied with the direction of the Monarchy. So it was an important social group at that time. The Military School was manageable by the formation of its officers.

Cartographic knowledge was vital for the military's action, both in times of war and for care with the national territory.

Professor Luiz Cruls was the director of the Observatory of Rio de Janeiro, the principal of the country and through his classes it is possible to understand some empasses of the first national map produced in the Republic.

The main debate was in the method, some sectors advocated triangulation of the whole territory, following the model of the French map, believing that map was the most accurate according to the paradigm of science of the time. In the classes of the Military School, Luiz Cruls tries to demonstrate that this method would be impracticable by the extension and topography of the Brazilian territory. As for the expectation of the first scientific Republican map, this was accomplished two decades later, with the letter to the millionth presented at the International Exhibition of Commemoration of Independence in 1922 by the hands of civil engineers of the Engineering Club and not of the military, as was the hope of Luiz Cruls, and his students.

History of Cartography; History of Astronomy; Brazilian's Military; Geodesic; First Brazilian Republic

One map away from "civilization": The Brazilian participation in the International Map of the World

Rildo Borges Duarte, Instituto Federal do Sul de Minas Gerais - Campus Passos

This work has as main objective the discussion about Brazilian participation in the International Map of the World (IMW) project, idealized by the German geographer Albrecht Penck during the 5th International Geographic Congress, held in the city of Bern in 1891. The initiative to insert the Country in this cartographic project, with the engineers of the Rio de Janeiro Engineering Club as its main advocates, would aim to meet the modernizing eagerness of the republican state and its hegemonic classes as part of the territory and its population domination and control project. This discourse had as a theoretical background in the geographical theses already circulating in Europe among those who worried about the destiny of a world girdled between imperial powers and areas of new and old colonies. In Brazilian lands, institutions and characters interested in modernizing and integrating the territory from materialities (such as the great railroad and telegraph projects) and of being able to show Brazil as belonging to the role of the so-called "civilized nations" would be compiled from this thought. In this sense, geographic knowledge of the territory, translated into cartographic language, served the interests of those who wanted to advance "civilization in the Country", hence the importance of actively participating in projects such as the IMW as a way of

showing itself capable of Map the most hidden points of the territory and with that to attract investments and immigrants.

Modernization; Territory; Brazil; Cartography; Geography

Science and territory: considering the relation between hour and cartography at the beginning of 20th century examining the example in Acre

Sabina Ferreira Alexandre Luz, MAST

Brazilian territory has always been a focus of attention from those who were in power. The possibility to obtain more territories was the reason for that attention. Territorial division in Brazil as in South America was initially made as a negotiation between the colonizers. At 19th century, that process turned to be the establishment of national borders in South America. The limits from those colonies became then a more detailed delimitation of national boundaries.

The beginning of 20th century represented to Brazil the period when the drawing of its national frontiers took their final lines with the addition of the Acre territory established by the Treaty of Petrópolis (1903). Nevertheless we can not say that the national frontiers were entirely lined off at that occasion. The process of delimitation, specially it comes to frontiers, is liable to constant negotiations and redefinitions by both sides of those frontiers. Despite that fact, we can affirm that at the beginning of 20th century the great lines of the Brazilian territory were established.

Considering the addition of that part of the territory, there was a big effort from the military engineers as well as from astronomers in Brazil to expand the scientific and cartographic knowledge from that region. That effort was specially focused on getting the right coordinates of some geographical marks at that region. The hour factor became for that reason a crucial element to calculate those coordinates. We can observe then a special interest for the hour theme at the firsts decades of 20th century in Brazil from those who were directly involved with the territory delimitation. Our aim is therefore to demonstrate how science and territory were connected by the hour element important and even essential to both spheres. We will analyse some maps made for the Acrean territory as well as some new methods to establish the local time used at that period to verify that possible relation.

History of cartography; Brazilian territory; First Brazilian Republic; time measurement

106. Technical Assistance Programs: From Instruments of Foreign Policies to Political Tools in the Hands of International Organizations

Creating the need: selling atomic commodities for Latin America

Edna Suarez-Diaz, Universidad Nacional Autonoma de Mexico UNAM

Gisela Mateos, Universidad Nacional Autonoma de Mexico UNAM

As soon as the International Atomic Energy Agency (IAEA) was created (1956-1958), one of its main purposes was to assist developing countries with technical assistance, training and exchange programs on nuclear matters. This decision was reflected in the annual appropriations and budgets assigned for these purposes, with the help of the United Nations Expanded Program for Technical Assistance (EPTA). However, this enthusiasm was not shared by all state members in the newly created agency. Even more, not all countries were considered as fit “recipients”.

In order to create the need for atomic knowledge and commodities, the IAEA embarked in a series of international missions, which surveyed local “stages of nuclear development”. The promotion of

nuclear sciences and technologies as a tool for modernization faced skeptical actors in many countries, as reflected in the correspondence between national atomic commissioners, resident representatives of the United Nations Technical Assistance Board (UNTAB), as well as functionaries in the Vienna headquarters. At stake were issues of sovereignty and modernity, but also of local priorities which did not align with the advertisement of nuclear solutions to development. In this talk, we will address the path to create a need for nuclear energy commodities, eventually resulting in the acquisition of a research reactor (TRIGA Mark-III) by the Mexican National Nuclear Energy Commission (CNEN) in 1964. This transaction took place with the mediation of the IAEA, as a way to avoid a bilateral agreement with the United States Atomic Energy Commission, a typical diplomatic maneuver of Mexico's sovereignty struggles.

Technical assistance, research reactors, Mexico, IAEA

Agriculture, Development, and American Empire, 1890-1940

Jessica Wang, University of British Columbia

Historical studies have generally depicted international development as a post-World War II, cold war era phenomenon. In the late nineteenth and early twentieth centuries, however, imperial powers also implemented developmental projects in order to pursue their economic and foreign policy goals, serve the cultural expansionism of their self-proclaimed civilizing missions, and also to collaborate in mutual efforts to ensure an international environment suited to imperial advantage. The deployment of agricultural knowledge formed a critical part of such endeavors. For the United States, agriculture was central to the project of state-building from roughly the 1860s to the 1930s. With the establishment of land grant colleges and universities under the Morrill Act of 1862, along with the creation of the U.S. Department of Agriculture that same year, agricultural experts gained institutions with which to perpetuate their disciplines and to bring their knowledge to bear on questions of statecraft. At Cornell University, a center of agricultural expertise, faculty members engaged in agricultural projects in China, the Philippines, and Puerto Rico during the period from 1890 to 1940, and these experiences provided important foundations for cold war development programs. By examining this earlier history of American-sponsored agricultural projects, scholars will be to understand more fully the history of development and the continuities between the age of high imperialism and the cold war order.

development; agriculture; agricultural science; United States

The IAEA's Technical Assistance Program: A Way to Standardize the World

Maria Rentetzi, National Technical University of Athens

One of the most valuable diagnostic applications of radioactive isotopes during the 1960s was the determination of the uptake of radioactive iodine by the thyroid gland of patients suffering from thyroid disorders. Since there was not a standard method to carry this procedure worldwide the newly established International Atomic Energy Agency embarked in a major standardization project financed through its technical assistance program. IAEA scientists constructed a calibration equipment- a box like suitcase that included a dummy figure of the upper part of the human body filled with a small amount of radioiodine. The suitcase included a number of standard vessels of various sizes and shapes containing amounts of mock iodine. From spring 1962 to the end of 1965 one of the IAEA scientists visited 199 medical isotope laboratories in 41 countries carrying the calibration box. The aim was to

standardize the measurements of the uptake of radioactive iodine worldwide. The Agency was willing to calibrate laboratory equipment in the UN Member States and at the same time to promote its standardized technique of measuring thyroid radioiodine uptake for general use. Different laboratories worldwide have already performed similar measurements with different techniques developing their own “house” methods. The first that took a more systematic approach to the method were the physicist at the Medical Division of the Oak Ridge. They undertook a thyroid-uptake calibration program in the 1950s. The idea was simple. They created a model of the upper part of the human body-a mannequin- and use it as a standard to calibrate scintillation detectors and other measuring devices in different US laboratories. In addition, the team send the mannequins to a number of countries including Australia, England, Japan, and Egypt. The measurements and calibration was performed locally and the suitcase, containing standards and the mannequin, was sent back afterwards with the compilation of the experimental results. The IAEA, however, introduced a more innovative approach, one that only an international UN organization would have taken up. The IAEA scientist traveled with the suitcase, performing measurements in each laboratory around the world. In this paper I discuss the above case as one of IAEA's early attempts to curve a niche and legitimize its position not only within the system of UN specialized agencies but also within the broader scientific community through its TA program.

IAEA, Technical Assistance Program, Radioiodine measurements

108. Knowledge by the Book: Manuals in the History of Science

Recipes for Recombining DNA: A History of "Molecular Cloning: A Laboratory Manual"

Angela N. H. Creager, Princeton University

Laboratory instructions and recipes are sometimes edited into commercial book projects with a wide circulation. Even in the late twentieth century, publications of this nature remained influential. For example, laboratory protocols used in a 1980 Cold Spring Harbor summer course on Molecular Cloning of Eukaryotic Genes were subsequently edited into a manual whose first two editions (1982 and 1989) sold 95,000 copies. Though the title of the publication is "Molecular Cloning: A Laboratory Manual," it became popularly known by the last name of its first author, Thomas Maniatis. (This despite the fact that the second edition changed the order of the coauthors, with Joseph Sambrook and E. F. Fritsch appearing first.) Not only was the “Maniatis manual” a standard reference tool for molecular biologists already using recombinant DNA techniques, but also its recipes and clear instructions made gene cloning accessible to non-specialists. In this case, a laboratory manual contributed to the rapid spread of genetic engineering techniques throughout the life sciences, as well as to industry. This paper will explore the origins of this manual (in a summer course at Cold Spring Harbor Laboratory), its publication history, and its reception.

molecular biology, manual, cloning, laboratory, genetic engineering

Systems, Catalogues, and Nomenclators -- Books and their Uses in Eighteenth-Century Natural History

Bettina Dietz, Hong Kong Baptist University
Staffan Müller-Wille, University of Exeter

Eighteenth-century natural history saw the emergence of a variety of genres that have their early modern forebears but only acquired a standardized form produced for mass consumption with the so-called Linnaean reform of nomenclature and classification. Systematic enumerations of all known plant and animal species, like Linnaeus's own *Systema naturae* (1735), garden catalogues and local floras, field guides and auction catalogues of natural history collections, as well as indexes and "nomenclators" of various formats were produced on a massively increasing scale all over Europe and beyond. Historians have only recently begun to turn to these technical sources of natural history knowledge whose chief characteristic is that they were not so much produced to be read for entertainment and enlightenment, but rather to be used as tools to enhance the accumulation and circulation of natural history information and to drive forward their global project of recording all plant, animal, and mineral species.

On the basis of selected case studies we are going to discuss, first, how this literature can be approached by historians of science and, second, how its uses can be reconstructed. The main problem results from the fact that it often conspicuously lacks semantic content; the texts in question have no narrative, no argument, and sometimes even do not contain a single full sentence. Instead, they gain their meaning from the disposition of words, resulting in lists (often numbered), tables and highly standardized, technical descriptions. In reconstructing the use of these texts, two main contexts need to be distinguished: individual research, in the field, the cabinet, or the study, on which book annotations, manuscript notes and excerpts, as well as collection catalogues and labels can cast light; and collective research practices of accumulating, exchanging and adjudicating information which can be analyzed through correspondence and references in publications, especially footnotes. Taking these texts seriously in their materiality reveals that their production and consumption, in conjunction with the collection and exchange of specimens, played a major role in the consolidation of enlightenment conceptions of science, nature, and order.

eighteenth century; natural history; books; information; lists

Mapping and making theriac

Hjalmar Fors, Uppsala University / Karolinska Institutet
Nils-Otto Ahnfelt, Uppsala University

In the Renaissance, the ancient composition for theriac was codified through the work of philologist-herbalists such as Pietro Andrea Mattioli and was subsequently incorporated into most major European pharmacopoeia. Theriac enjoyed a continued existence, albeit in increasingly simplified versions, throughout the 19th century and into the present. This paper presents our work on reproducing this famous medicine in the laboratory (in some of its 17th-, 18th- and 19th century incarnations) and on mapping out of the historic contexts and textual traditions to which theriac belonged. In particular, we correlate changes in theriac's composition against changing patterns of world trade, shifting meanings assigned to the sensuous aspect of medicines, and the perceived efficacy of complex composite drugs. By placing a medicine in the center of our narrative and examining it through a broad spectrum of methods –including the experimental– our aim is to construct a novel interpretation of the longue duree history of European medicine from the Renaissance to the present.

Reading Alchemically: Early Modern Guides to Impossible Practices

Jennifer Rampling, Princeton University

Dozens of early modern treatises claim to offer straightforward instructions on the theory and practice of alchemy, including all the steps necessary to produce the philosophers' stone and a range of medicinal elixirs. Yet the resulting works often seem to obfuscate more than they explain: omitting vital information, disguising ingredients and practices behind cover names, and describing outcomes that seem, to modern eyes, impossible. Were such "instruction manuals" ever intended to offer guides for actual practice, or did they serve other ends – from attracting patrons, to persuading sceptics of the truth of alchemy? I shall draw upon a variety of alchemical "manuals" written or compiled by English alchemists in the sixteenth and early seventeenth centuries, to argue that these treatises could indeed serve as technical manuals – although not always of the kind we might expect. These writings offer advice not only on practical techniques, but also on the process of reading alchemically: guiding readers through the exegetical minefield of alchemical writing, to help them extract meaningful chemical recipes from old and obscure texts. I will also report on my own attempts to follow these instructions, by following some early modern recipes in a modern laboratory setting.

alchemy; chemistry; notebooks; experiment; annotations

In between field guide and ultimate book – A manual of biological classification in time, 1920s-1980s

Mathias Grote, Humboldt-Universität zu Berlin

Taxonomic manuals occupy a curious and ambivalent position in the life sciences. They serve as field guides, or books used to find and identify organisms. Therefore, manuals were to comprise easily usable and up-to-date records of species, ordered e.g. in the form of keys or indices. On the other hand, some manuals, such as Bergey's Manual of Determinative Bacteriology, have occupied a privileged position as the ultimate book ('bible') on microbial systematics. Therefore, they were confronted with the demand of presenting secured, permanent and universal knowledge, e.g. in the form of a 'natural classification'. The making, composition and reception of Bergey's, a manual globally used by microbiologists, allow to understand how biological order emerged in between these different functions of the manual. Special attention will be paid to the eight (re-)editions of Bergey's from 1923 to 1984 and the question of how editors coped with an ever increasing influx of new data and novel taxonomies, and the conflicting need to secure the established knowledge and order. The resulting maintenance work on "old knowledge" in light of novelty will bring to the fore a fundamental problem of modern biological classification, that is, of establishing a natural order on the basis of incoming, contingent empirical data. Moreover, by juxtaposing the published, re-edited book with the imagined timeless book of nature's order, taxonomic manuals allow to analyze the unfolding of scientific knowledge in time, and thus its historicity.

manuals, books, taxonomy, microbiology, 20th century

109. Toward a Global History of Data, Measures, and Indicators

Racial classification in early Brazilian statistics (1890-1920): scales and uses

Alexandre de Paiva Rio Camargo, IUPERJ / UCAM

This paper addresses the meanings of racial classification in the Brazilian statistical experience during the period known by Brazilian historiography as the Early Republic (1889-1930). As Mara Loveman put it (Loveman, 2014), census taking in Latin America has been oriented to two political projects: a descriptive one that helped to define the cultural boundaries of the imagined community; a prescriptive one that set racial miscigenation as a positive singularity among the international system of states. In the United States, the census played a major role both as a laboratory for racial theory and as an objective device for attaching legal implications to ethno-racial divides (Anderson, 1988; Schor, 2009). In Brazil, in contrast, racial classification was not attached to the production of legal restraints against black population. Race would remain the basic grid for social distinction. Nonetheless, it has never constituted a clear line isolable by blood and progeny. Instead, race would be combined with other visual signs of social position, such as family networks, wealth and cultural capital.

In this scenario, we will compare the different ways by which racial classification were encoded and presented in two sets of the broader statistical discourse in Brazil: the national censuses of 1890 and 1920, and the demography data generated by the federal health office and disseminated at the hygienist press. The first set were engaged in the construction of a symbolic space made of an homogeneous population. The second targeted population on a local scale, emphasizing differences and divides. While some reports drew a meaningful link between race and disease, others simply disregarded race as a dependent variable, at the rise of the eugenic reasoning. In doing so, we seek to map the shifts in racial statistics according to the scale of representation: as a descriptive device that enabled the unitization of a mixed nation and well as a normative device that helped to spatialize the poor, the sick and the subjects of government.

Bibliography:

ANDERSON, Margo. The american census: a social history. New Haven: Yale University Press, 1988.

LOVEMAN, Mara. National colors: racial classification and the State in Latin America. New York: Oxford University Press, 2014.

SCHOR, Paul. Compter et classer: histoire des recensements américains. Éditions de L'EHESS, 2009.

health statistics; ethno-racial classification; nationalism and census identity; sociology of quantification

The Fall and Rise of Typical Sampling in 1950s China: Locating 'Method' in Great Leap 'Madness'

Arunabh Ghosh, Harvard University

1958 marked a watershed in the history of the early People's Republic of China (PRC). The execution of the first five-year plan (1953-57) had been a success, meeting and in many cases exceeding the targets that had been set. And yet, instead of a second five-year plan that built upon the first one, China was launched down the path of the Great Leap Forward (GLF; 1958-1961). Today, the GLF is inextricably linked with the massive famine that followed in its wake. As a subject of research, the famine has been explored from various perspectives and the total number of deaths attributable to it remains a lively and contested subject. Such scholarship typically acknowledges—though often only in passing—that the GLF was accompanied by the dismantling of statistical work, which fundamentally crippled the state and leadership's ability to access reliable data. And yet, there does not exist any detailed account of what precisely such 'dismantling' meant. In this paper, I explore that question by tracing the evolution of statistical capacity building since the establishment of the

PRC in 1949 and determining what precisely happened to statistics and statistical work during the GLF. Relying upon archival reports, newspapers, contemporary professional journals, and memoirs, I trace how a form of typical sampling—典型调查 (dianxing diaocha)—was revalidated as the only true way to ascertain social fact. Such an exercise can help us think more broadly about the history of data, state (technical) capacity, and the ways in which ideas about ‘accurate’ and ‘representative’ measurement remain at the heart of global modernity.

China; Great Leap Forward; Statistical Method; Sampling

Statistics and the State in India

Jahnvi Phalkey, King's College London

My presentation will focus on the history of statistical sampling techniques in twentieth century India and trace its role in providing answers to the problem of scale in governing the newly established country. I will do so through the study of research and practices of sampling at the Indian Statistical Institute, Calcutta: what were the projects that demanded sampling and how and by whom were they carried out. Moreover, what were the larger institutions of government into which these projects plugged in or drew either funding or authority from, both at home and abroad, especially through their close association with the United Nations Sub Commission on Statistical Sampling.

Statistics, India, Sampling

Quantifying the Normal Mind

John Carson, University of Michigan

This talk will explore some of the ways in which quantification was used to try and define what a normal person, psychologically speaking, might be. Although on the surface a rather straight-forward project, the normal mind proved, in practice, to be quite elusive. As medical jurisprudence pioneer had noted in the 1830s, "the greatest possible variety is presented by the mental phenomena in a state of health." This variety both tantalized and frustrated psychologists and others seeking to tame it through the use of statistical methods and ever larger data sets.

normal; mind; quantification; psychology

Sampling choice: An early history of India's NSS and national planning as visions of statistical inclusion

Laxmi Seshu Poornima Paidipaty, Cambridge University

In the earliest rounds of India's National Sample Survey, a relatively small selection of villages and residential areas (just 1833 in total) were used to represent the wider Indian population, which numbered close to 361 million. Over time, the scope and the nature of the surveys would change dramatically, but this starting point demonstrates just how new and experimental large-scale sampling was at mid-century. The British colonial state in India, though an exemplar of enumeration,

primarily surveyed land and population. As Timothy Mitchell has explained, ‘the economy’ as a discrete sphere of human activity can be viewed as a historically recent phenomenon, whose emergence depended (amongst other things) on new techniques of national income accounting. Having at best a weak and incomplete regime of household taxation, the Indian government was particularly disadvantaged when it came to national income estimates. Yet economic planning, rapid industrial growth and development demanded better and more substantial economic measures. It is in this context that the NSS represented a radical and risky attempt to measure the economy. This paper will explore the development of this uncertain, new science, and will examine the mutual interdependence between sampling and planning. Drawing primarily on the P. C. Mahalanobis archives of the Indian Statistical Institute, this essay argues that data histories need to be written alongside accounts of the broader historical and political exigencies that give rise to new information. Important scholarship has already shown that data is a highly contingent social product. Yet data histories are still frequently written in isolation, as though data is produced independently of its uses. This essay examines how large-scale sampling as a technique went hand in hand with new, planning-based models of the national economy. In particular, the paper examines how operations research and experimental policy frameworks for modeling dynamic social structures impact the development of large-scale sampling. In the process, the essay pays close attention to difficulties faced by samplers (especially in accounting for informal economic activities and women’s labour), and early political objections to sampling as a source of comprehensive economic data.

statistical sampling, economic planning, India, Mahalanobis, development

Censuses of Madness: Does Civilization Cause Insanity?

Theodore Porter, University of California, Los Angeles

The creation of hundreds and then thousands of asylums in the nineteenth century was a response to the promise that they could cure this terrible affliction. Instead the populations of these institutions grew and grew, seemingly without bounds. Most asylum doctors did not believe that this increase was any measure of the actual numbers of insane. Yet Esquirol’s hypothesis that insanity was a disease of civilization could not easily be refuted, and tallies of madness provided the most promising avenue for determining if this could really be the case. These ranged from full-blooded censuses involving doctors and priests as well as ordinary census-takers to rough estimates of travelers and officials who claimed to speak for South America or Senegal.

data; asylums; statistics

110. Cosmopolitanism and the Local in Science and Nature

The Silk Roads to Modern science: Rethinking the Scientific Revolution

Arun Bala, Independent Scholar

The Scientific Revolution is generally seen as shaped by events within Europe alone, but recent studies suggest that influences from the Arabic, Chinese and Indian traditions of science also played a significant role in the origins of modern science. This paper examines why these wider connective perspectives require us to relocate the historical and geographical boundaries of modern science. It thereby highlights the need to trace the local origins of the Scientific Revolution into the cosmopolitan context of interactions across the Eurasian arena.

Constructing a cosmopolitan view of life: Reflections on the technologies of life from Darwin to CRISPR/CAS9

Giuliano Pancaldi, University of Bologna

It is well-known that Darwin's natural selection owed much to the economic theories popular in his times, and especially to Malthus. The circumstance is used often to remind us of Darwin's ties with the social and political context of imperial Britain, and rightly so. It is less well-known that Darwin's conception of an "economy of nature" intertwined with a number of technological metaphors that played a key role in the 'Origin of species', and opened the door to a new, potentially cosmopolitan view of life.

In the first part of the paper I will discuss some of Darwin's technological metaphors. I will show that these metaphors helped him to by-pass questions traditional in natural philosophy and religion. Questions such as "what is life?", or the first origin of life. Questions that remained notably unanswered in the 'Origin'. The same metaphors were instrumental in circulating worldwide a view of living structures that Darwin conceived as "the summing up of many contrivances, each useful to the possessor, nearly in the same way as when we look at any great mechanical invention as the summing up of the labour, the experience, the reason, and even the blunders of numerous workmen" ('Origin', 1859, 485-6). The 'Origin's technological view of life received comparatively little attention among Darwin's contemporaries. However, a survey of the history of biology during the following one hundred and fifty years would show that a technological approach has remained a distinctive trait of the post-Darwinian life sciences. It has contributed to their success by shifting attention away from research traditions that retained stronger ties with local cultures and local religions. The "technologies of life", apparently, are potentially more "cosmopolitan" than other notions of life variously rooted in local cultures and traditions.

The concluding part of the paper will be devoted to a few reflections on the status of the technologies of life in an age when practitioners are proud to proclaim that "biology is technology". We will try to assess features and limits of the peculiar "common world" resulting from the negotiations, aimed at establishing some common guidelines of scientific and moral conduct, that were carried out among the 500 scientists from more than 20 countries who met in Washington in December 2015 following the spread of the new technology of life known as CRISPR/CAS9.

Cosmopolitanism; Technologies of life; Charles Darwin; CRISPR/CAS9

Cosmopolitanism and local kinds of things

Gordon McOuat, University of King's College

Cosmopolitanism has of late been a very hot topic in political and ethical theory. Literature too. Not so much the history and philosophy of science. The field remains fixated on "circulation" models as alternative to centre-periphery disseminations. This paper will expand on preliminary discussions of cosmopolitanism initiated in dialogues between Canadian, European and South Asian scholars regarding the usefulness of "cosmopolitanism" as a category in the history and philosophy of science. It will begin with attempts to get beyond caricatures of cosmopolitanism associated with a certain interpretation of Enlightenment and Kantian universalism and will offer an alternative, generative, view of cosmopolitanism drawing on the model of "cosmopolitan species" found in ecology. The

claim will be that there are certain kinds of things (and people) that are cosmopolitan and certain kinds that are not.

cosmopolitanism; postcolonialism; circulation of knowledge

What does a 'Cosmopolitan History of Science' look like?

Lesley Cormack, University of Alberta

The traditional overarching story of the historical development of science, made famous by a generation of scholars such as Herbert Butterfield, writing after WWII, told an intellectual story of the building of modern science, block by block, and leading to the triumph of western science as a universal explanatory model. In recent years, there have been numerous challenges to this narrative. First, we have become aware of the deep richness of Islamic science and the constant interconnections among eastern Asia, central Asia, the Middle East and Europe for several hundred years before the end of the 16th century. Second, we have had to confront the complexity of contacts among cultures and knowledge holders all over the world, as Europeans ventured out. Less successful has been taking this into the 20th century, where the triumph of modern western science is still the narrative arch. If the development of natural philosophy and science has been the result of a rich interconnection of various intellectual traditions over the years, how should this change the way we think of the enterprise itself and its modern history? If we think about a non-hierarchical interaction of knowledge communities as might be imagined with the term Cosmopolitan science, does this give us a richer way to develop a new macro-analytic tool with which to understand the development of science over the world? How would it change the way we think of modern science and its future? Or would it? This paper will sketch out some of the options for telling such a story, and suggest a larger research agenda for understanding the global interconnections – both cosmopolitan and not -- of science over the *longue durée*.

Cosmopolitan; historiography; circulation of knowledge

111. Internationality: Modes of International Cooperation in Science

Science policy in the South and foreign assistance from the North: new organizational modes of internationalization in Argentina during the sixties

Adriana Feld, CONICET

In a recent study Kreimer (2010) has identified various stages of internationalization of science in Argentina. The first stage, called *founder's internationalization* (1870–1920), witnessed the arrival of European and American scientists who played an important role in the institutionalization of new research fields or disciplines. The second stage, called *liberal internationalization* (1920–1970), is characterized by the emergence of local leaders (the pioneers) who institutionalized their disciplines in the country and created international networks that enabled them to send disciples overseas and to interact with mainstream research centers. During this period, local leaders (like the Nobel Prize winner, the physiologist Bernardo Houssay) individually negotiated grants from institutions such as the Rockefeller Foundation.

However, some literature reveals, at least, two elements that can help to refine this periodization. On the one hand, as we showed in previous works, between mid-50's and mid-70's, a process of institutionalization of science policy begun in Argentina and in some Latin American countries (Feld,

2015). On the other hand, this period is also considered as the golden age of international scientific and technical assistance to Latin American universities and research centers, aiming to export progress (Levy, 2005). Our question here is how both new national and international scenarios influenced the organizational and cognitive features of the internationalization of science in Argentina. With that purpose, we analyze three elements that shaped that process: a) the role of modern scientific actors in new fields, that acted as policy makers (modern as opposite to traditional in terms of research practices and policy conceptions); b) the policy of donor institutions, like Ford Foundation and UNESCO; c) the requirements in Argentina of new and more complex research fields to be set up. To analyze the intervention of these elements we follow the case of physics in Argentina between 1955 and 1966. The hypothesis is that all these elements configured a programmatic mode of internationalization that co-existed with the liberal mode.

Technical Assistance - Argentina - Science Policy

International Collaboration and Colonial Networks in Francis Gano Benedict's racial metabolism research programme

Elizabeth Neswald, Brock University

From 1925 until his retirement in 1937, Francis Gano Benedict, director of the Carnegie Nutrition Laboratory of the Carnegie Institute of Washington, directed an international project to measure the metabolism of different human population groups, a project he called “racial metabolism” studies. Although Benedict was not the first physiologist to assume that energy metabolism and nutritional needs differed in these so-called “races” and to try to find ways of ascertaining this, through his status as internationally leading nutritional physiologist and director of a prestigious, well-funded institution, as well as through his decades of carefully cultivated international scientific exchange, he was in a unique position to coordinate a research programme with global scope. This paper discusses the organization and practices of Benedict's racial metabolism research project, in which researchers measured the basal metabolism rates of individuals indigenous to various non-North American and non-European regions and compared them to the norms Benedict had derived from his decade long study of Caucasian Bostonians. It looks first to the ways in which the project harnessed the capacity of the Carnegie Institution and its various departments, in particular the traveling departments, and how it made use of colonial and missionary networks. It turns then to the practices and problems of international research practices and delocalization. Instruments and researchers moved between the lab and the field, working in diverse and challenging environments and facing different demands on their skills. The controlled conditions of the Nutrition Laboratory facilitated the development and use of standard methods and apparatus, but field conditions and diverse sites threatened the commensurability of results. Neither instruments nor standardized methods travelled well. Finally, the question of internationalization must be expanded to include not only the internationality of researchers, but also that of their human subjects. A study of internationalization in a life science must also consider the interaction between researcher and research subject. Successful metabolism measurement demanded collaboration between researcher and subject, a highly fraught relationship, when it was based, as colonial encounters typically were, on differences in power and the scope of agency.

internationalism; race science; metabolism; nutrition; race

Paleoanthropology as World History in the Cold War

Emily M. Kern, Princeton University

In February 1948, the United Nations Educational, Scientific, and Cultural Organization (UNESCO) announced a plan to produce a “history of peaceful relations” between peoples, centering the history of scientific and cultural development. The Scientific and Cultural History of Mankind, as it came to be known, was billed as a comprehensive, universal human history, from the evolution of mankind and the development of the first tools, languages, and cultural practices, up to the (then) present day. Between 1951 and 1961, when the first volume of the History of Mankind was published, expert authors chosen by UNESCO for both their intellectual credentials and their internationalist spirit engaged in a synthetic process of history-writing in conjunction with UNESCO officials, international scholarly experts, and select delegations representing UNESCO’s member states, in order to produce a totalizing history of peaceful exchange and development that was explicitly devoid of any national bias or particular political point of view.

In this paper, I look at the ways paleoanthropological knowledge was mobilized as a type of human history in the postwar era, using the first volume of the History of Mankind, which dealt with the period stretching from the first hominin to the rise of urban civilizations, circa 1200 BCE, to explore the complex cultural and political meanings that postwar paleoanthropology acquired when it was cast as a type of human history, and how these meanings were developed and contested in the international sphere. I focus on disputes over the location of the historical cradle of the human species, which emerged as particular point of contention between the British, French, and American authors of the History of Mankind and national commissions of experts tasked with reviewing the text, especially those from the Soviet Union and the Eastern Bloc. Rather than reading this as a simple case of Soviet obstructionism, I center competing conceptions of universal human history, between the Marxist and western capitalist worlds, and how different definitions of “human-ness” were used to piece together a long history of humankind. The story of the History of Mankind reminds us that attempts to naturalize particular conceptualizations of the human species have a political history that has been constructed and comes out of contingent knowledge-making processes, and that both the ‘universal’ and ‘scientific’ may look different from various points of view.

internationalism; paleoanthropology; UNESCO; human origins; postwar

Making restrictions international: Chemical regulation and chemical lists in the late 20th century

Evan Hepler-Smith, Harvard University

Scientists and regulators who sought to control chemical pollution in the 20th and 21st centuries have grappled with two problems of scale. The first is geopolitical: both chemical commerce and chemical pollution are global, whereas most legal frameworks for controlling the hazards of chemicals to the environment and to public health are local or national. The second is epistemic: scientific and legal mechanisms for chemical regulation have channeled intense attention toward individual chemical substances, whereas chemicals of potential concern number in the tens of thousands.

This paper will argue that, from the 1960s through the present day, chemical regulation has been made international in two stages. First, chemicals were made into objects of governance at the national level, through the implementation of a variety of laws regulating chemicals within the jurisdiction of different nations. Then, through regulatory interfaces developed within the United Nations Environment Program and the Organization for Economic Cooperation and Development, these national systems of regulation were brought into (limited, tentative) alignment. Each stage, I argue, has centered on list-making, a principal activity throughout global chemical regulation, but an

ICHST
2017

activity that has constituted different kinds of objects of chemical regulation in different times and places. I will follow the history of the production, use, and regulation of two substances, the insecticide Lindane and the industrial chemical PFOS, focusing on developments within the US, Germany, and the UN. In doing so, I will show how chemical regulation was made international through the making of chemical lists.

internationalism, regulation, toxicology, chemistry, information technology

The League of Nations' Republic of Letters: Science, Chauvinism, and Henri Bergson at the International Committee on Intellectual Co-operation

Geert Somsen, Maastricht University

One of the clearest ideological manifestations of scientific internationalism in the twentieth century was the "International Committee on Intellectual Co-operation" (ICIC) of the League of Nations. Established in 1922, the ICIC brought together a select group of celebrated scholars and scientists, whose joint activity was meant to be a beacon of supranational cooperation in a war-torn world. It aimed to create "fraternity (...) in high intellectual spheres, from where it can progressively descend upon the nations." The ICIC was a Republic of Letters on public display.

Its leader, however, presents us with a problem. Henri Bergson, the famed French "élan vital" philosopher, presided over the ICIC from its start to 1925. He himself expressed the aims described above, and, after the first committee meetings, concluded "verification" of the principle that science and scholarship transcend nationality, showing the way out of international strife: "we are here among friends. This could only happen among intellectuals." Yet the same Bergson had been an ardent chauvinist during the preceding war. From the first roars of the guns of August he had defended the French military effort and rejected German culture as "barbaric". Moreover, he had been a select member of the French delegation sent to the United States in April 1917 to persuade president Wilson to take up arms and join the war effort – successfully, as it turned out. How could a fiery chauvinist become a lofty internationalist? How did belligerence turn into pacifism? Rather than a change of mind or a disillusion with war that some historians have concluded, I will look at the interwovenness of French nationalism and internationalism, following it through the war and into the new institutional context of the League of Nations. I will also point to the development of an Allied, and especially American, rhetoric of high civilization after 1917.

League of Nations, Henri Bergson, International Committee on Intellectual Co-operation, internationalism, nationalism

Esperanto en Scienco kaj Tekniko : Central European Visions of Esperanto as Language of International Scientific Communication in the Early 20th Century

Jan Jakub Surman, Max-Weber-Kolleg, Erfurt

International science needs international media. Before English became the means to transgress the scholarly Babel, several models were discussed and practiced. One of the leading concepts in the early 20th century was the use of international auxiliary languages as scholarly tongue, like Esperanto, Ido or Intelingua. In my talk I follow the ideas of Esperanto as scientific language presented by Central European scholars between 1908 and 1930.

In my talk I look at the strategies of institutionalization of Esperanto as language of science and scholarship in the early 20th century and after the First World War. I concentrate particularly on two

persons: Pole Antoni Grabowski (1857-1921) and Czech Alexandr Sommer-Batěk (1874-1944). Both were chemists, responsible for reforms of chemical terminologies in Polish and Czech respectively. At the same time, both were active Esperantists and internationalists – in 1908 Grabowski was head of the Polish Esperantist Association, while Sommer-Batěk lead the Czech one. Grabowski, active mainly before the WWI, was an influential translator of e.g. Polish poetry into Esperanto, but wrote also on questions of Esperanto internationalization for science, defining it as an auxiliary language. Sommer-Batěk on the other hand proposed reforms to Czech chemical terminology and then composed chemical terminology in Esperanto, where he saw it as a language to serve as only a tool of international communication. After the War, he concentrated on propagation of pacifism and (Catholic) cultural enlightenment in post WWI Czechoslovakia, devising also own international writing – neoglyfy.

Concentrating on these two personalities I describe the pre World-War II evolution of idea of Esperanto-led internationalism in sciences in Central Europe and its inscription into discourses of nationalism and “olympic internationalism”. By comparing Grabowski’s and Sommer-Batěk’s outlooks on Esperanto to another great chemist-Esperantist, Wilhelm Ostwald, I will try to answer the question if there was something “Central European” in my protagonists’ ideas. I argue that my protagonists’ shared a particular approach to Esperanto caused by linguistic variety in the region and by the discourse of importance of internationality for national purposes. And this approach survived the WWI, and in fact even WWII, as evidenced by revival of discourse of Esperanto as a scholarly tongue in the 1970s.

Esperanto; Scientific Language; Chemistry; Internationalism; Central Europe

The international politics of science popularization at the League of Nations in the late 1930s

Jaume Sastre-Juan, CIUHCT-UL

Andrée Bergeron, Centre Alexandre-Koyré (CNRS)

On February 17th 1939, the International Committee of Intellectual Cooperation of the League of Nations organized a three-day conference on how science popularization through the mass media (mainly radio) could be used to advance the cause of peace. The members of the appointed committee included politically influential scientists and science administrators, such as Julian Huxley or Henri Laugier. The Rockefeller Foundation, which at that time had an active interest both in mass communications and in science popularization, was invited to attend and sent delegates to Paris. After the conference, a project for creating an ‘International Center for the Dissemination of Science’ was drafted. A second meeting was scheduled for September 1939, but the war broke out and dismantled the plans.

Through the case study of this particular conference, we will examine the late 1930s efforts within the League of Nations at using the popularization of science as a tool for international relations. We will address how these internationalist discourses and practices were related to the specific political agenda of each of the actors (the British liberal left, the Rockefeller Foundation, the French left-wing scientific internationalists). We will put the conference debates at the League of Nations in the context of the contemporary political debates around the popularization of science: the ‘visible college’ in Britain, the scientific elite related to the Front Populaire in France, and the ‘science and society’ movement in the United States were all actively pursuing science popularization. Finally, we will argue that the continuity in actors and discourses compels us to look at the postwar efforts at using science popularization as a tool for international relations in the light of the interwar debates within the League of Nations.

League of Nations; Internationalism; science popularization; International Committee of Intellectual Cooperation; Rockefeller Foundation

Internationalism in Words and Deeds: The Case of "Long-Range" Historical Linguistics

Judith R. Kaplan, Penn Humanities Forum

My contribution to the symposium will examine internationalizing tendencies in twentieth-century comparative linguistics—that branch of the discipline concerned with patterns of language relationship and variation over time. It will comprise two sections: one devoted to the practices of sharing and communicating linguistic research across borders and research traditions; and another investigating the theoretical universality of linguistic claims made thereby. The former involves not only the “brute” languages in which research is published and presented, but also a crucial consideration of the nature and instantiation of linguistic data over the last century. Corresponding to the subthemes of “travel and communication” and “organizations and institutions,” my analysis in this first part of the talk will be conceptually grounded in Sabina Leonelli’s conception of data journeys. Empirically, it will historicize and describe the Evolution of Human Languages Project (EHL)—a joint databasing venture of the Santa Fe Institute and the Russian State University for the Humanities that is self-described as “An international project on the linguistic prehistory of humanity.” This tag line points to the second line of inquiry, one that corresponds to the symposium subtheme of “ideology and geopolitics.” That is, a desire among the so-called “long-rangers” (a diffuse group including members of the EHL) to generalize beyond established language families (e.g. Indo-European) up to, and including, the hypothesis of linguistic monogenesis. Proceeding from the assumption that all the languages of the world derive from a single common ancestor, some long-rangers have attempted to reconstruct historical universals (e.g. *tik, the word for “finger” attributed to proto-World). This project has captured widespread popular attention, opening up a window into the ideological stakes involved.

Internationalism; Data; Linguistics

Making Science International: Geographical Pathology and the Search for the Causes of Cancer, 1925 – 1975

Lucas Mueller, Massachusetts Institute of Technology

Cancer, carcinogenic toxins, and toxicity have often been described as matters of the industrialized world and its nationalized cancer research programs. However, these histories occlude the important international history of making of scientific knowledge about cancer and its causation in the twentieth century. By describing the history of geographical pathology, its narrowing focus on cancer, and its institutionalization from the late 1920s to the mid-1970s, this paper argues that the framework of cancer research and the scale of its different methods was constantly reorganization between the national and international domains.

Scientists and politicians struggled over the sound organization of cancer research: what types of investigations constitute cancer research? Which modes of cancer research fall into the responsibility of the international domain, and which in the national domain? Based on the analysis of reports, conference proceedings, articles in medical journals, and archives in Great Britain, France, and Kenya, this paper shows how scientists’ and politicians’ answers to these questions were embedded in the domestic and international politics of interwar internationalism, and, in the postwar decades, the Cold War, decolonization, and European integration as well as research methods and scientific disciplines. The field of geographical pathology sought to discover the etiology of specific diseases by measuring its frequency in defined populations through pathological diagnosis. The comparison of incidences

and the respective geographies would provide clues for uncovering the etiology. In the late 1920s, the International Society for Geographical Pathology was founded to provide an international forum for the field. After World War II, international organizations began to promote the field. When France proposed the foundation of what would become the International Agency for Research on Cancer (IARC) in 1963, the proposal was initially met with resistance by other industrialized countries that were establishing their own national cancer programs. Geographical pathology, already conducted on an international scale, was positioned to become the Agency's research program without being seen in competition with national programs. In turn, its international nature also lent legitimacy to the establishment of an international agency. This organization was consequential for the scope of cancer research.

internationalism; cancer research; epidemiology; toxicity; postcolonial

From the Ditch to the Philosophical Domain. Acquiring Knowledge Beyond the Boundaries of the Known World in Natural History, 1750-1800

Margaret Meredith, Vrije Universiteit

In the eighteenth century, men of learning in Europe and its imperial outposts rarely identified the acquisition of knowledge with the concrete and mundane details of transcending vast stretches of physical space let alone the entire globe. Instead, what made the reach of their scientific endeavors "international" in their minds was the existence and proper functioning of "society," the idealized community of dispersed but mutually bound members also known as the Republic of Letters on whose labors the advancement of knowledge depended. As long as the knowledge these men created or acquired was communicated and thus shared, the advancement of human knowledge would be secured. Yet, if as historians of science we want to make sense of the advancement of natural knowledge in terms of how the historical actors understood it was realized, then we must find a way to bridge the gap between their idealized rendering of the process and the vast physical reality of nature that they must have transcended to achieve it.

This paper offers an attempt at bridging this gap by examining the struggles of American and European naturalists to revise and add to the confused corpus of knowledge of American animals in the second half of the eighteenth century. The explicit spatial dimension inherent in natural historical inquiry offers a convenient device for examining the means by which cabinet-bound naturalists acquired specimens of North American animals (or knowledge about them) in places far from the sociable worlds in which they worked: in the ditch, the forest, or in the vast unexplored tracts of the North American continent. This paper argues that success as they saw it lay in establishing sociable liaisons that provided a reliable link between their world within "society" and these spaces considered devoid of it.

natural history, eighteenth century, communication, transatlantic

Science in the Liberal Internationalist Imagination, 1939-1945

S. Waqar H. Zaidi, Lahore University of Management Sciences

In 1940 the newly formed New York-based international relations think tank the Commission to Study the Organization of Peace released its preliminary report to the public. Reflecting on the need to ensure postwar peace and security, the report built its arguments for the formation of a powerful postwar international organization on the effects of science on international relations. "Science",

began the Report, “has profoundly changed the conditions of man's life upon this earth” – it had spawned not only “the annihilation of time and space by steam, electricity, radio, and the airplane” but “modern industrial civilization” itself. But the Report also warned that modern scientific inventions enabled total war, and so threatened to annihilate civilization. The report was widely circulated in public policy, government, and academic circles; and its authors included several leading authorities on international relations, most prominently James T. Shotwell, Eugene Staley, Quincy Wright, and Clyde Eagleton. With funding from leading internationalist institutions, the Commission continued to stress the science-based transformation of international relations in its later publications issued during the war – publications on topics as diverse as the postwar international economy, international organisations, collective security, disarmament, and intellectual cooperation. Although no doubt shaped by the individual concerns of the authors involved, in this paper I argue that these reports suggest a wider internationalist turn towards understanding international relations through science and technology. Not just the Commission, but other think tanks in the United States and Britain, as well as government officials interested in postwar reconstruction, incorporated science into their narratives on postwar international relations and their suggestions for how to keep peace after the war. These proposals represented an attempt to reconcile belief in the internationalising effects of modern science with the reality of increasing nationalist rivalries and increasingly global and deadly warfare. But in them science also functioned, I argue, as an organising master-trope – depicted as an international and internationalising enterprise pulling the world together towards an internationalist future, it allowed the authors to claim that only liberal internationalist solutions could solve the problems of international relations.

internationalism; international relations; World War Two; postwar reconstruction

112. Circulation of knowledge and scientific institutions: the Americas, Western Europe, South Asia (1750s-1914)

The Quito Polytechnic School: circulation of knowledge in a Jesuit-run scientific institution in the Andes (1869 - 1879)

Ana Sevilla, Universidad San Francisco de Quito

Elisa Sevilla, Pontificia Universidad Catolica del Ecuador

This paper focuses on a case study that illuminates the process of knowledge production in non-European spaces of modernity. The return of the Society of Jesus to the newly independent nation-states of Latin America is our point of departure. The interaction between the Society of Jesus and the Ecuadorean State promoted the circulation of people and ideas. This relationship defined the characteristics of scientific activity in both sides of the equation: Jesuit science and State-sponsored science.

In the second half of the nineteenth century, the Ecuadorian President Gabriel Garcia Moreno (1821-1875) asks the Society of Jesus to send three Jesuits capable of taking charge of the three sections of the faculty of sciences to be set in Quito, namely that of pure and applied mathematics, physics and chemistry, and the natural sciences. The Society of Jesus responds positively and in 1870 the “best Jesuit-scientists” trained in Germany, according to the Superior-General of the Jesuit Order Father Peter Beckx (1795-1887), are sent to South America. In October 1870 the Quito Polytechnic School opens its doors and becomes the place where many scientific ideas are discussed for the first time in Ecuador.

In the course of their movement from Europe to America, the role that the three Jesuits would meet undergoes a transformation. They leave Europe under the auspices of Father Beckx to form part of a science faculty; and they arrive to America under the protection of Garcia Moreno to establish a Polytechnic School. The difference between the two projects was substantial and would become a source of enormous difficulties in the course of the following years. In 1875, Beckx writes an angry letter asking by who's disposition, with what authority, by who's persuasion was a supposedly Jesuit-

run Polytechnic School established. The most important conclusion we can take out of Garcia Moreno's correspondence with Father Beckx is precisely this frustrating process of long-distance and multi-cultural negotiation, and divergence in interests. The story of Quito's Jesuit-run Polytechnic School is an example that shows that knowledge transfer is not linear but rather constantly negotiated, curved, and altered.

Circulation of knowledge, Jesuit-science, Nation-building, South America

Contributions of the Amazonian populations to XIXth century scientific travels: a case-study of Bates' and Agassiz's expeditions to Brazil (1848-1866)

Anderson Pereira Antunes, Casa de Oswaldo Cruz / Fundação Oswaldo Cruz

Science is collaborative work and XIXth century scientific travels were no exception. In fact, fieldwork was even more fundamentally social. The success of a scientific expedition was partly determined by the naturalist's association with a diversified network of collaborators, which could include government authorities, local guides, hunters, slaves, and indigenous groups. The contributions of local inhabitants were especially important, since they often possessed empirical knowledge invaluable to the natural historical exploration of the regions where they lived. It is interesting to note that although naturalists made frequent mentions to the aid gotten from their collaborators in diaries and correspondences, scientific reports and other writings directed at a specialized audience often favoured an impersonal and objective style. As a result, the presence of local inhabitants was often made invisible. Only recently has the historiography of scientific expeditions changed its focus to the circulation of knowledge between "centres" and "peripheries" and to the colonizing and despoiling aspects of these expeditions. This research will look into the contributions of Amazonian populations to two of the most eminent expeditions to have landed in Brazil. Born in England, Henry Walter Bates was still an aspiring naturalist when he made plans for his Brazilian voyage with Alfred Wallace in 1848. After 11 years, he returned home not only with an immense quantity of insect specimens, but also having made observations that allowed him to elaborate his theory on mimicry, which was taken by Darwin as proof of natural selection. Louis Agassiz, on the other hand, was already a well-respected naturalist when, in 1865, he put together an expedition with the explicit goal of gathering evidence to refute Darwinian evolutionary theory. Although not entirely successful, Agassiz contributed with over 76,000 specimens to the collections of the Museum of Comparative Zoology, at Harvard. Despite their differences, both expeditions heavily relied on the aid of local Amazonian residents whom they encountered, especially to the collection of specimens. In this work, it will be seen how the books, diaries and correspondences written by naturalists, and also what was published in local newspapers, allows us to map the network of collaborators involved with these expeditions, identifying who they were and how they were able to contribute to the scientific work of these naturalists.

Scientific expeditions; XIXth century Brazil; circulation of knowledge; Louis Agassiz; Henry Walter Bates

Public lighting technology and the imaginary. From the local to the global: rhetoric of utility, display, circulation of the 'lanterne à réverbères' in the Bourbon administrations and political metaphors (Paris, Barcelona, (1759-1793)

Benjamin Bothereau, EHESS

This paper aims at analyzing the circulation and the interactions of technical and symbolic perceptions of the lantern between two urban contexts in the 18th century. More broadly, it is intended to contribute and highlight our understanding of the social mechanisms that follow the invention of technical objects : transfer, judgment, agreement, acclimatization and social integration. Crossing history of technology, visual and material culture, it analyses the circulation of the « lanterne à réverbères » technology between Paris and Barcelona and the evolution of its representations, focusing specially on the second half of the 18th century. The « lanterne à réverbères » also named « lanterne optique » was an improved lantern optimizing the luminous intensity by using concave metal reflectors -the new optical components- to direct the beam of light. Our main corpus consists of the technical periodical *L'Avant-Coureur*, trade cards, mémoires of 1750's technical enquiries and political caricatures – revolutionary and counterrevolutionary. Aside from treatises and all forms of codified knowledge, innovative artisanal practices of inventions promotion through exhibitions, demonstrations and workshops tours (example of the French inventor Rabiqueau) contributed to the object's accessibility and acculturation.

Parisian streetlighting, together with the Police institution, were both created by the Bourbon administration as a mean to control the urban territory and to pacify the streets. A competition on "the best way to light the Parisian streets" was co-organized by the Police and the Académie Royale des Sciences from 1763 to 1766. The creation of Barcelona's first public lighting in 1757 under the centralized supervision of the new Bourbon administration (French influence) took part in the process of rationalization of the state administration and urban conditions by town planning conducted by the Real Academia Militar de Matematicas. Barcelona adopted the Parisian streetlighting system after successive « enquêtes » missions (Jaime Bort, de Montealegre) in the 1750's in Paris, and the « réverbère » technology finally entered Spain with the French lantern maker C. Duclos in the 1770's.

Paradoxically, the object integrated popular imagery by becoming a visual and semantic code of the uprisings violence and more widely a political metaphor of the 1773 Barcelona «avalot de les quintes» uprising and of the French revolutionary dynamic .

Circulation of knowledge; Transnational history; Interactions; visual culture; material culture

The medical market in Portuguese America in the eighteenth century: circulation, supply and consumption of medicines

Danielle Sanches de Almeida, Fiocruz/EHESS

The medicinal plants that came from the East and from Spanish America were moving towards Europe or Portuguese America, following the rhythm of the merchandise imported from the various European ports, traveling through a complex circulation system. In this movement agents, organized trade networks, interpersonal and family relations and the state action where the transmission of the goods were executed of diverse forms, happening through the local exchange until the sale in auctions collected in the main European squares.

The economy of the medicine or the trade of medicines followed different rhythms of the great international products like pepper, cotton, sugar and tobacco with respect to the quantity of these types sent and to the typology of the business. While these, more precisely sugar, had rhythms of navigation based on contracts established between the crown and individuals - in the case of sugar -

or through the royal monopoly - as was the case of pepper since the middle of the sixteenth century - , medicines needed Skilled tradesmen, the so-called druggists who supplied the European and colonial medical market, and had a smaller overall circulation of the product.

american plants, medicinal, circulation

Slaves, gardens, and natural history in the eighteenth-century Mascarene Islands

Dorit Maria Nicola Brixius, European University Institute Florence

This paper is dedicated to the relation between cultivational activities and the distinct roles of slaves in the eighteenth-century Mascarene Islands. Slaves were extremely important for the establishment of the islands, not only because of their physical work but also because of their plant knowledge, which in individual cases allowed them to hold higher positions in the gardens. Following recent and vivid calls to re-think the relation between slavery and the movement of plant knowledge, I suggest a different approach to slavery by considering slaves in the Mascarenes as signal agents and active carriers of plant knowledge, ranging from botanical to medical knowledge and from collectors to skilled cultivators by highlighting the different tasks of slaves in relation to agricultural activities and plant knowledge. Treating slaves as subjects and active actors of the Mascarenes' natural history makes thus a significant contribution to questions, which scholars have finally began to ask about the role between knowledge production and the slave trade.

This paper sets a particular focus on the relation between useful crops, medical plants, and the tasks slaves fulfilled in the various gardens and private habitations of the French colonial islands. These gardens included the private gardens in Isle de France (present-day Mauritius), namely Monplaisir (the later royal Jardin des Pamplemousses) and the engineer Cossigny's garden La Palma, the French East India Company's garden Le Réduit, as well as the colonial garden of the neighbouring island Bourbon (present-day La Réunion). In a wider sense, at the backdrop of economic motives and anti-slavery sentiments, it investigates the role and treatment of the gardens' slaves who lived and worked on the gardens' sites. Thus, it explores the relation between colonisers and slaves from very distinct backgrounds who worked in the gardens, managing the entangled coordination of agriculture, the cultivation of useful plant, and the local actors' visions of cultivational performance.

Slavery, natural history, gardens, French, Mascarenes

Cartographers and the spatial dynamics of the atlantic slave trade XVIII-XIX: the Portuguese maps

Iris Kantor, Universidade de São Paulo

As well as the upheavals caused overseas by the Thirty Years War in the seventeenth century, the Treaty of Utrecht, the Seven Years War and the Napoleonic expansion changed the South and North Atlantic commercial networks configurations, and redefined the sea routes and the commercial interest in global scale. In the case of the Portuguese empire, the structural transformation of the slave trade, triggered by the creation of Pombal trading companies, meant the incorporation of the eastern coast of Africa in Atlantic slave trade networks, as can be seen in cartographic coeval documentation. By the end of the 18th Century the European ports and factories in Africa were fully recorded by the cartographers from Portuguese America with great accuracy, spreading out important nautical and geographical information. Comparing the maps of different maritime empires, what can we deduce about the transformation of the South and North Atlantic commercial

networks? What are the differences between the Luso-brazilian mapping and European cartography in the same period? We seek to highlight the circulation of the military, ethnographic and mercantile information. I will try to underline the heuristic potential of the cartographic sources for the study of the Atlantic slave trade from 1750 to 1850.

Slave Trade, Cartography, Ports, South Atlantic, Navigation Knowledge

Le rôle des jésuites dans les transferts astronomiques Inde – Europe, de la fin du XVIIe à la fin du XVIIIe siècle

Jean Michel Delire, Univ. Libre de Bruxelles and Haute Ecole de Bruxelles-Brabant

Du fait de leur formation très exigeante, les missionnaires jésuites furent de fins observateurs, des religions de l'Inde, des nombreuses langues qu'on y parlait et des pratiques astronomiques locales. Parallèlement à leurs observations, relatées dans les Lettres édifiantes et curieuses, ils ont utilisé leurs connaissances astronomiques pour améliorer la cartographie et les voyages en mer. C'est dans ce but, parmi d'autres, que Louis XIV envoya en 1685 une ambassade vers le Siam dont faisaient partie 6 jésuites, avec à leur tête le Père de Fontaney, astronome reconnu depuis ses Observations sur la Comète (1681). Une deuxième ambassade (1687) devait rap-porter du Siam un manuscrit astronomique d'inspiration indienne, que Jean-Dominique Cassini (1625-1712) analysa dans les Mémoires de l'Académie des sciences. D'autres manuscrits, dit Duchamp et Patouillet, n'atteignirent la France qu'après 1750, alors que les savants de l'Académie préparaient de nouveaux voyages pour observer les passages de Vénus devant le soleil (1761 et 1769). C'est ainsi qu'après un long périple en Inde, dans l'Océan indien et jusqu'à Manille, l'astronome Guillaume Le Gentil devait publier en 1772 de nouveaux éléments astronomiques indiens, qui servirent, avec les manuscrits précédents, à Jean-Sylvestre Bailly pour rédiger son Traité de l'astronomie indienne et orientale (1787). Entretemps, de nouveaux missionnaires avaient atteint l'Inde, les uns (Andreas Ströbl et Anton Gablsperger d'Ingolstadt en Bavière) en 1740 pour répondre à la demande de Jai Singh un raja astronome, fondateur de Jaipur, qui désirait—II (1689-1743) les autres (Claude—connaître les instruments et les méthodes d'Europe Boudier et Jean-François Pons de Toulouse) en 1734 pour préciser les coordonnées de nombreux lieux, toujours à l'aide des méthodes astronomiques mises au point par J.-D. Cassini. Le dernier des jésuites à rester en Inde, dans des conditions extrêmement difficiles après la suppression de l'ordre, fut Joseph Tieffenthaler (de Bolzano au Tyrol), auteur d'une remarquable carte de l'Inde. Comme beaucoup des membres de la S.J., il ne re-vint jamais en Europe et c'est Anquetil-Duperron qui publia sa carte après sa mort en 1785. Dans cet exposé, nous allons envisager le parcours, les recherches scientifiques et les préoccupations de certains de ces jésuites et essayer de discerner quels éléments ils ont pu apporter à l'image en Europe des régions parcourues.

Jesuits; India; Astronomy; Geography

How Locality Affects the Contents of Knowledge: The Asiatic Society of Bengal, 1784-1794

Kapil Raj, EHES

The Asiatic Society of Bengal was founded in Calcutta, the budding capital of British India, in 1784. Based on the model of the Royal Society in London, its aims were to study all the knowledges of Asia, from its ancient history, geography and religions to its ethnography, metrology, astronomy, mathematics and other sciences. Through an analysis of the annual discourses of its founder-

president, Sir William Jones (1746-1794), this paper will analyse the central role that Calcutta plays in the making of knowledge within this institution of Asia and the world. The presentation will be based principally around Jones's attempt to map the relationship of the different families of mankind across the globe following the Deluge and the subsequent dispersal of the sons of Noah. It will show how Jones's theories differ from those of his predecessors, being the unique result of the encounter between European and Asian linguistic, theological, political and imperial traditions in the learned and imperial-administrative institutions of Calcutta. Finally, it will bring out the role of knowledge institutions in controlling the circulation of heterogeneous knowledge practices and rendering possible their sustained encounter.

Intercultural encounter; Europe; South Asia; Asiatic Society of Bengal; William Jones

Acclimatizing Animals: Colonial Logics of Environmental Health for the Non-Human, 1771-1814

Kit Heintzman, Harvard University

In 1771 François Eloy Beauvais was the first veterinarian exported on a colonial mission. The French Ministry of the Interior and Minister of the Marine sent Beauvais to l'Isle de France (present day Mauritius) in the hopes that a veterinarian would make the island habitable for non-human-animals, and concomitantly produced an island better habitable for humans themselves. Three earlier settler missions had attempted to colonize l'Isle de France before it the French Crown acquired it; the rats, hurricanes, and infertile land had were repeatedly deemed insurmountable. l'Isle de France had no indigenous human population and no indigenous edible or draft mammals/quadrupeds. Beauvais's task was to preserve what little fauna existed and made its way to the island sharing the vessels and trade routes with slaves, rice, and spices. Alimentation and acclimatization were intimately linked in Enlightenment colonial-settler science. Climatic theories of the body insisted that exposure to new geographies and ecologies altered mutable European bodies. To have the tropical heat and rains crashing around the skin while consuming Metropolitan provisions made the colonialist's body two worlds at once, and the purported cure was to adopt local eating practices; maintaining Metropolitan eating practices risked the health of the colony. Using scientific papers and administrative correspondence from the National Archives of Mauritius and Les Archives Nationales d'Outre Mer, I trace the extension of climatic theories of food-sustenance to non-human-animal through Beauvais's work on the island. Comparing his research with the climatic theories of animal bodies in Metropolitan France, this paper argues that Beauvais not only adapted his scientist thinking and practices to a new climactic topography, but also an entirely new relationship between humans and other animals as a part of a broader colonial logic and the specificities of this island. Animal patients were entangled in every aspect of the project of empire, from working alongside slaves in the botanical garden to labours in fortification from feeding colonists to convalescing soldiers. Rendering the island in the service of empire was not a solely human affair.

Animals, Medicine, Food Sciences, Colonial, Mauritius

Scientific travels, the circulation of knowledge and the French Revolution in global context: a second look on science, politics and empire c. 1780-1820

Maria Pia Donato, Centre National de la Recherche Scientifique
Jean-Luc Chappey, Université Paris Panthéon-Sorbonne

Contrary to commonplace understating of the French Revolution as an age of disruption of scientific voyaging, the decades spanning from c. 1780 to 1820 marked a significant turn in the way traveling and travels were conceived, planned and brought about by Europeans both in Europe and the Mediterranean and in transoceanic lands. Although historians and historians of science have repeatedly underscored the role of the State and the war in promoting scientific voyaging as part of the struggle among powers to impose Western domination on larger parts of the globe, they still tend to underestimate the impact of politics in the intellectual and practical framing of scientific expeditions. The aim of this paper is to reassess the scope and organisation of French scientific travels in respect to the rapid political transformations of the period. Drawing on case studies in several fields of expertise and knowledge, like mining and mineralogy, natural history, anthropology, archaeology, we shall discuss the features of travels promoted by the French revolutionary state and the shifts they underwent under different regimes from constitutional monarchy to empire. Case studies will thus highlight a number of intertwined though partly contradictory phenomena, namely an increasing hiatus between individual motives and institutional constraints. They will further show the fragility of clear-cut distinctions between sedentary metropolitan savants and 'wandering' amateurs. Not less importantly, they can shed light on the emergence of a new geography of civilisation, i.e., the decline of previous notions of the world's history and the setting of new frontiers of otherness across Europe and the globe.

Scientific travels; empire; French Revolution; civilisation

Retracer une science. Parcours de médecins et contours de l'enseignement anatomique au Canada (1788-1867)

Martin Robert, Université du Québec à Montréal

Par son histoire, peu connue hors de ses frontières, le Québec se situe au carrefour de différentes cultures. Ancienne colonie française intégrée à l'Empire britannique au milieu du XVIII^e siècle, il partage une frontière avec la Nouvelle-Angleterre. Les premières écoles médicales sur son territoire traduisent ce caractère singulier. Fondée par la communauté anglophone et protestante de Montréal en 1823, la faculté de médecine de l'Université McGill a des racines dans la tradition médicale écossaise et les réseaux professionnels des États-Unis. En revanche, les facultés de médecine fondées par les catholiques francophones entretiennent des liens intellectuels forts avec la France et, par l'entremise des archevêchés de Québec et de Montréal, avec le pouvoir du pape à Rome. Afin de mettre en évidence cette dynamique à la fois culturelle et scientifique, nous allons étudier dans cette communication la formation d'un enseignement anatomique dans les écoles de médecine du Québec au XIX^e siècle. En nous penchant sur les voyages d'étudiants en médecine et de professeurs d'anatomie ainsi que sur les emprunts transnationaux en matière de cursus de formation et de matériel pédagogique, nous chercherons à comprendre comment s'organisait et se transmettait la science anatomique au sein d'une profession médicale québécoise traversée par ses appartenances multiples.

Dissection; Anatomie; Québec; Canada

Bombay-Rio de Janeiro avec une escale à Paris: circulations scientifiques et contrôle de la peste bubonique (1894-1920)

Matheus Alves Duarte da Silva, Ecole des Hautes Etudes en Sciences Sociales

A partir de 1894, la peste bubonique est devenue un problème majeur de santé publique dans plusieurs pays, comme l'Inde et le Brésil. Malgré l'absence de cas en France, l'Institut Pasteur de Paris s'est placé, au début de la pandémie, comme une des institutions centrales dans la production des savoirs sur la maladie. Pourtant, cette centralité s'est vite déplacée vers d'autres laboratoires, comme le Plague Research Laboratory, basé à Bombay, et l'Instituto Soroterapico Federal, fondé à Rio de Janeiro, où de nouvelles connaissances sur le fléau ont été créées. Les objectifs de cette communication sont, d'abord, d'analyser comment ces trois laboratoires sont entrés en interaction pour produire des savoirs sur la peste. Ensuite, nous chercherons à comprendre comment ces savoirs ont circulé et ont changé entre ces trois pôles géographiques. Parmi les circulations qui ont marqué cette histoire, nous en avons choisi deux, en raison de leur importance dans le contrôle de la maladie. D'une part, celle du sérum antipesteux, créé à Paris en 1895, testé à Bombay à partir de 1896 et modifié à Rio de Janeiro après 1900. D'autre part, le vaccin antipesteux, inventé au laboratoire indien en 1896, transformé par les chercheurs brésiliens puis modifié et utilisé à Paris en 1920. Pour répondre à ces questions, nous suivrons les mouvements de certains médecins et scientifiques affiliés à ces institutions, de même que les déplacements des objets et des techniques auxquels ils consacraient leur travail. Pour ce faire, nous analyserons des cahiers de terrain des chercheurs, les lettres échangées entre eux et les rapports de leurs laboratoires. Ainsi, nous espérons qu'il sera possible de comprendre les relations et les circulations scientifiques établies non seulement entre des institutions basées en pays du nord et du sud, déjà beaucoup analysées par l'historiographie, mais également celles entre des pays du sud, aussi distants et différents que l'Inde Coloniale (1858-1947) et le Brésil de la « Première République » (1889-1930).

Knowledge Circulation; Bacteriology; Plague Research Laboratory; Institut Pasteur; Instituto Soroterapico Federal

Fixed stars traveling around the Earth: the 18th-century metamorphoses of Flamsteed's Celestial Atlas across scales (actors, institutions, nations and empires)

Thomás A. S. Haddad, University of S. Paulo

The Brazilian National Library in Rio de Janeiro houses a set of engraved copper plates that were used to print the first Portuguese celestial atlas. It was published in Lisbon, in 1804, by the Royal Press, itself part of a larger project of reform of metropolitan and colonial administrative and cultural institutions. This reformist project included the reshaping of the educational system, the establishment of museums, observatories, a scientific academy, and investment in the adaptation of foreign scientific works. Our celestial atlas is a case in point: it was an abridged translation of a French one from 1795, by astronomers J. Lalande and P. Méchain, which was in turn a revised edition of a former atlas from 1776, prepared by instrument maker J. Fortin – which was, ultimately, a revision of John Flamsteed's 1729 posthumous magnum opus. This was based in his painstaking catalogue of stars visible from London, although it included a planisphere of the southern skies based on the observations E. Halley had made in the island of St. Helena. It was intended as a monument to British astronomy and to the memory of Flamsteed himself, both of which converged in the Greenwich Observatory. The subsequent French editions made ever more use of southern observations, especially those originating from N.-L. de Lacaille's global network of observers. In French hands, the atlas became a wholly different object, gaining airs of a handbook of practical astronomy with an emphasis on the tools needed for multi-sited observational enterprises. Thus, the

French versions testified to the sheer change of scale in the practice of astronomy that took place during the 18th century, while resolutely claiming a central role to France's scientific institutions in the shaping of such large-scale projects. When it traveled to Portugal, the atlas changed meanings once again, now serving as an affirmation of sovereign integration in purportedly international Enlightenment models of scientific practice. By exploring the story of the transformations that the atlas went through, its changing meanings to different actors, the range of scales encapsulated in the book itself and in its movements (from single observatory to multiple observers, from one language to another, from Europe to America), including the distinct modes of engagement of the "national" with the "transnational" in settings of empire building or contraction, the paper intends to address the questions posed by this symposium.

Flamsteed's Celestial Atlas; 18th-century astronomy; Scales; Translations and appropriations

Instructions, mémoires et collections d'histoire naturelle en circulation dans les XVIIIe et XIXe siècles

Verona Campos Segantini, Universidade Federal de Minas Gerais

Letícia Julião, UFMG

Marta Eloisa Melgaço Neves, UFMG

Lúcio Flávio Silva, UFMG

Aline Damasceno, UFMG

Tlhema Palha Cruz, UFMG

Ce travail propose la discussion des questions liées à la conformation d'espaces de collection et exhibition de spécimens et d'échantillons d'histoire naturelle au Portugal et ses colonies, à partir des dernières décennies du XVIIIe siècle. Par ce biais, il sera nécessaire un exercice de réflexion qui consiste à comprendre, d'abord, la production et la circulation des instructions et des mémoires élaborées dans des différents contextes collectionneurs qui étaient destinés à guider les pratiques de connaissances de la nature. Nous reconnaissons une importante documentation produite au Portugal et écrite par Domingos Vandelli et ses impliqués dans l'exécution des voyages philosophiques et dans la conformation des cabinets d'histoire naturelle.

La première étape comprendra la comparaison de ces instructions à d'autres textes qui ont circulé dans différents contextes collectionneurs en comprenant des connexions, des arguments et des pratiques communes. Cette étape est destinée à reconnaître dans ces documents une typologie textuelle proche à la structure d'argumentation de manuels qui suggèrent la circulation de prescriptions relatives aux pratiques d'observation de la nature, de collecter, de préparer, d'afficher et conserver.

Lorsqu'on souligne la circularité de ces instructions nous mettons en question la nature mimétique de ces textes, qui, en plus de la tentative de conceptualiser, de décrire les intérêts et les domaines de l'histoire naturelle, au moment de la formation de cette Science, cherchent également à systématiser des pratiques, prescrire des façons d'enregistrer, de préserver, conserver et de disposer les collections dans des espaces de collectionnisme, dont dépendaient la tentative de classer et de comprendre les hiérarchies de la nature.

Nous prenons comme hypothèse que les instructions écrites aux voyageurs, aux naturalistes et aux employés de l'administration coloniale étaient interdépendants à un moment de renforcer l'intérêt pour la nature. Cela, lié à la volonté de l'inventaire, résulte dans la création des espaces de collection tels que les cabinets et musées d'histoire naturelle. À cet égard le propos de la recherche est aussi la discussion de la circulation des collections entre le Brésil et l'Europe, faites par les voyageurs et les employés de l'administration coloniale naturaliste, soulignant l'intérêt dans les échantillons des trois règnes de la nature et aussi par des objets ethnographiques.

histoire naturelle, instructions, collections

114. Gatekeepers, Informants, and the Undisciplined Labor of Scientific Knowledge Production

A Cold War Laboratory: Foreign Researchers and Medical Infrastructure in Pahlavi Iran

Elisabeth K. Burton, Harvard University

Between the 1950s and the 1970s, Iran under the Pahlavi regime played a strategic role in Cold War geopolitics. To support Iran's military and economy as a key First World ally, hundreds of Western experts passed through the country to advise on all aspects of infrastructural and technological development. Navigating between the Iranian state, foreign aid organizations, and private medical institutions, Western scientists visiting Iran enjoyed privileges and freedoms denied to local researchers. In this paper, I focus on French and American scientists who worked with the Institut Pasteur in Tehran, examining their relationships with Iranian medical staff and research subjects. I show how Iran's semi-colonial medical infrastructure provided a career launchpad for young Western researchers, namely André and Joelle Boué and Daniel Carleton Gajdusek. Meanwhile, using field journals, oral history records and scientific publications, I explore how their Iranian collaborators directly and indirectly shaped their assumptions and interpretations of medical data collected from subaltern populations in Iran and Afghanistan.

Iran; biomedical sciences; infrastructure; Cold War; networks

Bureaucratic Borders and the Making of a Foreign Medical Graduate

Eram Alam, University of Pennsylvania

"Doctor Shortage Nearing a Crisis," warned The New York Times in 1965. The meager production of US educated physicians coupled with the broadening of Medicare and Medicaid necessitated an expansion of health manpower to satisfy American demand. To address the shortage, Congress established a provision in the Hart-Celler Immigration and Nationality Act of 1965 that expedited the migration of skilled professionals to the US. Amongst the largest group of immigrants to enter were Foreign Medical Graduates (FMGs) from predominantly postcolonial Asian nations, with India and the Philippines providing the largest numbers. Foreign physicians arrived in the United States amidst the Cold War as unknown persons claiming to possess knowledge and expertise. To deal with the uncertainties of this labor pool, state and local bureaucracies became responsible for overseeing and validating a foreign doctor's presence in the United States. In this paper, I focus on the role of the Educational Council of Foreign Medical Graduates (ECFMG) and state licensing boards to show how these bureaucratic gatekeepers transformed disparate foreign practitioners into a universal medical labor force. The ECFMG was the initial obligatory passage point and had the unenviable task of deciding what criteria to use to "recognize foreign medical schools", defining what constituted "qualified," and identifying foreign medical graduates thoroughly. Upon completing the procedures set out by this organization, FMGs were confronted with state licensing boards, which made disclosure demands that far exceeded the demands of their US counterparts. By analyzing these two bureaucratic nodes in the FMG's journey from country of origin to clinical practice, I highlight the conditional entry of these practitioners who were invited into the nation to provide care for marginalized inner city and rural communities that were without physicians and considered "less desirable" by the US medical establishment.

The afterlives of insecticide-treated bed net research in Siaya: Social infrastructures and shifting vulnerabilities

Kirsten Moore-Sheeley, Johns Hopkins University

Insecticide-treated bed nets (ITNs) have become a cornerstone of global malaria control and are distributed by the millions across Africa and the global South. If one looks at how ITNs came to be understood as biomedical technologies, however, it is clear that these were not simply defined by scientists from the global North. Rather, African health workers, chiefs, research participants, and other non-scientists significantly shaped the production of knowledge about ITNs. My paper explores the role of Kenyan health workers, research staff, and trial participants in the largest-ever ITN experiment—conducted in Siaya, Kenya—to see how these people informed the construction of ITNs as biomedical tools. I examine how their social, translational, and technical labor helped secure statistically significant, robust results that demonstrated ITNs could reduce mortality anywhere. Their work was all the more important given the lack of health facilities and other public health infrastructure in the region. As the ITN experiment stimulated further biomedical research in the area, Siaya-based community health workers, research staff, and research participants learned to perform as part of the social infrastructure necessary to carry out research. This development has provided residents of Siaya with new, if precarious, economic opportunities (in the form of research work) and health care opportunities (in the form of experimental medical interventions). However, it has perpetuated inattention to building permanent health infrastructure, making Siaya increasingly susceptible to global health research.

Kenya; biomedicine; research; public health; technology

Dissonant Infrastructures: The tensions between science and public health embedded in sickle cell disease in Salvador, Bahia, Brazil

Melissa Creary, University of Michigan

Epistemic authority for knowledge production about sickle cell disease (SCD) in Brazil lay mostly at the feet of elite scientists associated with established institutions. These gatekeepers often focus on the biological and medical processes that take place within the body. SCD activists embedded in the public health infrastructure in Salvador, discursively deem the interest from scientists to be based in a paradigm that creates the person living with SCD as a commodity to clinical science. Tensions arise in this context as a result of the social reality that the production of “legitimate” knowledge about the science and medicine of SCD is dominated by individuals and institutions with no ties to the Sickle Cell Disease Movement, a closely linked entity to the larger Movimento Negro (Black Movement). What occurs when social infrastructures that “emphasize the durability and permanence of social systems within which biomedical knowledge production and labor occur,” (Dent, 2016) are at odds with each other? What takes place when the social milieu of place erodes these infrastructures? This paper will explore the ways in which activists in the municipal public health department for Salvador circumvent modes of elite knowledge production and reconfigure how SCD is defined by situating the discourse from “inside the body” to “outside” and from biological to cultural.

Brazil, social movement, sickle cell disease

Kinship and Care: Social Infrastructures for Maintaining Research in Terra Indígena Xavante

Rosanna Dent, University of Pennsylvania

The Xavante village of Pimentel Barbosa in Central Brazil offers little by way of built infrastructure for scientific research. While researchers might rely on a nearby government school and health post, a dilapidated building in the center of the village, or the shelter of a thatched home in the village, there are few signs of the high scientific productivity of the space. Although researchers are dependent on the relevant but distant networks of roads, labs, and refrigeration systems, it is primarily social infrastructures that have made Pimentel Barbosa a center of knowledge production. This paper examines how village residents have created social and affective systems to structure engagement with scientists. Since the 1950s, this one Xavante village has been the subject of dozens of scientific inquiries. They have hosted scholars from across the human sciences, from genetics or human ecology to linguistics and sociocultural anthropology. Over time they have refined strategies of engagement that aim to create and sustain enduring commitment on the part of the scientists who research them. Focusing on practices of adoption and the incorporation of researchers into Xavante kinship systems, I look at how relationship building and the inculcation of mutuality and reciprocal commitment have shaped trajectories of research. These relationships guide and direct the flow of research materials, whether audio recordings, gifts, blood samples, images, anthropometric data, or transcribed myths. Obligation and esteem, fostered through the extension of familial belonging, guide scientists to new lines of inquiry and result in unexpected social, political, and scientific engagement.

research relationships; kinship; social infrastructure; Indigenous subjects

115. Colonies as spaces of knowledge

Circulation and appropriation of knowledge in a unpublished Jesuitic manuscript: Paraguay Natural Ilustrado, by José Sánchez Labrador SJ. (1771-1776)

Eliane Cristina Deckmann Fleck, Universidade do Vale do Rio dos Sinos

In this communication, we present a preliminary analysis of the manuscript Paraguay Natural Ilustrado, written by Jesuit priest José Sánchez Labrador, between the years of 1771 and 1776, during his exile in Ravenna, Italy. This work, which is found in the Archivo Romanum Societatis Iesu (ARSI), is subdivided in six tomes – Earth, Water and Air; Botany; Mammals; Birds; Fish; Amphibians, Reptiles and Insects – in which, besides the perceptions about American nature, we found information relative to the healing knowledge and practices adopted by the indigenous populations of the regions of the Província Jesuítica of Paraguay. Beyond the therapeutic virtues of bezoar stones, insects and plants described in the work, it interests us, also, to demonstrate that in Paraguay Natural Ilustrado the missionary Sánchez Labrador gathered data from his own observations and from the information he obtained from the indigenous peoples, as well as from the information found in works written by other Jesuits or by layman scientists, with whom he established an interesting dialogue. The evidence of intertextuality and of appropriation of the knowledge of the intelligent and wise indigenous peoples, especially in relation to the therapeutic virtues of bezoar stones, insects and plants, will, therefore, also be broached.

Jesuitic manuscript Paraguay Natural Ilustrado; Circulation; appropriation of knowledge; Medicine

Colonial mobilities as seen in the case of the chemical and mineralogical analyses of a native copper sample amid 'Philosophical Journeys' to Brazil in the late 18th century

Ermelinda Moutinho Pataca, University of São Paulo

In 1782 a piece of copper was found in Vila da Cachoeira, captaincy of Bahia, Brazil, generating considerable controversy. The explanations for the large dimensions of the sample, about 1.5m in diameter, would follow two lines: either it was native copper, which would require further explanation using current theories of the Earth, or it was the result of the fusion of copper pans from old sugar mills of the region. To resolve the controversy, started in the colony and articulated in scientific and administrative circles in Lisbon, several chemical analyses were performed, both in Bahia and in Lisbon. Essays were conducted in the mint of Vila da Cachoeira, demonstrating the existence of chemical activities in the colony, in unconventional scientific spaces with the participation of the local community as eyewitness to validate the data. Small samples of copper and soil removed from the local river were also tested in the chemistry laboratory of the Royal Museum and Botanical Garden of Lisbon, under the direction of Domingos Vandelli, Italian physician and mastermind of a large project of “philosophical journeys” throughout the Portuguese Empire. Also, detailed descriptions were made by his disciple Manoel Galvão da Silva, who in 1783 was sent in a journey to Goa and Mozambique, via Bahia, where he was to seek concrete evidence about the origin of the object. The descriptions were sent to Lisbon with an engraving, for ease of visualization, since the object could not yet be removed to the metropolis, which happened afterwards. In this paper we analyze the local mobility of the sample between Vila da Cachoeira and Salvador, highlighting the complementarity of fieldwork, chemical analysis, and the place given to object in the Natural History Museum in Lisbon. We also study its mobilization in Lisbon, connecting chemical and mineralogical investigations in the laboratory, the reproduction of the engraving in the Museum’s drawing division, and debates that reached overseas minister Martinho de Melo e Castro. Vandelli favored an interpretation based on theories of the Earth, speculating that the mineralization of native copper could have occurred by aqueous sedimentation (Neptunism), or by volcanic fusion (Plutonism). Besides the expert networks directly involved, we give attention to the role of colonial and metropolitan authorities with their political aims, and to the participation of local population testifying the public character of scientific activity.

Chemistry, mineralogy, Philosophical Travels, Luso-brasilian science, Enlightenment

Circulation of knowledge and scientific connections in the city of Rio de Janeiro – 1781-1790

Heloisa Meireles Gesteira, Museum of Astronomy and Related Science

Astronomical observation during expeditions was not something new in the eighteenth century. As well as observing ephemeris, the presence of mathematicians, astronomers, and engineers on journeys can take us back to the 15th century, in the context of overseas expansion. In expeditions with a geodetic and astronomical tasks or even in surveys the presence of skilled people was important. To ensure accurate observation, portable instruments, tables, and books were part of the cargo of European ships.

In this paper we will focus on the work of a portuguese astronomer in Rio de Janeiro, Bento Sanches Dorta, between 1781 and 1787. During the years that Dorta lived in Rio de Janeiro he made almost daily entries of his observations. He observed, when weather conditions permitted, the immersion

and emersion of Jupiter's Satellites to find out the latitude and longitude of Castel Hill in Rio de Janeiro. On average, he noted 45 days that he had good conditions to work per year. For his observations he used an "achromatic lunette with single focus of 17 inches, constructed by Dollon". To stay informed about astronomical events he used the *Connaissance des Temps*, published in Paris. By checking this publication he was able to know the moment of astronomical events in other places, especially Paris and Greenwich.

My point is to explore how Bento Sanches, and other scientists that came to the Americas in the context of demarcation of the borders, could also have seen those missions as an opportunity to observe nature all over the world - in Sanches' case, the southern part of the American continent. We focus on the work done in Rio de Janeiro to shed light Sanches Dorta's working conditions while in the city. By identifying the places where he worked, the instruments he used, and the books he had with him, my objective is to see if it is possible to consider his observations as something connected and related to astronomical practices in Europe.

Scientific Instruments, Bento Sanches Dorta; Circulation of knowledge; astronomical voyages

Colonial or not colonial? 18th century missionary knowledge about China, between European expansion and Qing imperialism

Huiyi Wu, Needham Research Institute/Centre d'études sur la Chine moderne et contemporaine

The circulation of knowledge between China and Europe in the 17th and 18th centuries, mainly through the famed Jesuit mission, is usually regarded as relatively free from the colonial ambitions of Western powers, which became central the missions after the Opium Wars in the 19th century. This paper argues that the colonial question was not absent during the earlier period: missionary knowledge about China was shaped by different forms of both Asian and European colonial expansionism in an indirect and mediated fashion. On one hand, European networks of overseas trading and acclimatization shaped missionaries' outlook, prompting some to view the significance of Chinese knowledge through the lens of colonial enterprises. On the other hand, following in the steps of the Qing imperial expansion, missionaries increasingly undertook the study of the geography and history of China's periphery, often drawing on new scholarly resources produced by Chinese imperial institutions. I contend that the weak presence of the colonial question in the context of the Jesuit China mission precisely allows us to form a more nuanced view of the patterns of entanglement between science and empire.

Jesuit China mission; European expansion; Qing empire; circulation of knowledge; colonialism

The Spaniards in East Asia in the Sixteenth century: The Augustinians Andrés de Urdaneta and Martín de Rada and the 'problem of longitude' in the Philippines

Jose A. Cervera, El Colegio de Mexico

The Augustinian friar Andrés de Urdaneta (1508-1568) is famous for having participated in the discovery of the 'tornaviaje', or the sea route from the Philippines to Mexico across the Pacific, in 1565. From the beginning, the establishment of the Spaniards in the Philippines was surrounded by controversy, since it violated the Treaty of Zaragoza of 1529. The Spanish emperor Charles V had pawned to the king of Portugal his rights for a wide area of East Asia, including the Philippines and the Moluccas. After returning to Spain, Urdaneta had to give his opinion on the geographical situation of the Philippines. He concluded that, although it was evident that the islands were in the

territory pawned to the king of Portugal, they were contained in the Spanish demarcation according to the previous Treaty of Tordesillas (1494). That gave a certain legitimacy to the Spanish presence in the Philippines. Urdaneta wrote a Parecer (Declaration) in 1566, where he justified this conclusion using his own geographical knowledge and also the astronomical observations carried out by the Augustinian Martín de Rada (1533-1578) in the Philippines.

Urdaneta and Rada were wrong. The 'problem of longitude' was one of the greatest challenges in the 16th, 17th and 18th centuries history of science. There were several attempts to find a reliable method to find the geographical longitude. This problem was not satisfactorily solved until the end of the 18th century. Rada found the longitude of the Philippines with an error of 16°. That means that the archipelago was in the Portuguese demarcation not only according to the Treaty of Zaragoza, but also according to the Treaty of Tordesillas. However, history later proved that this scientific error was quite irrelevant. In any case, Urdaneta and Rada's calculations do not mean that those men were 'bad scientists', since they were using the book by Copernicus, published shortly before, for their calculations.

In this paper, I will study the scientific work by Urdaneta, analyzing his Parecer of 1566, and the astronomical observations by Rada in the Philippines. The astronomical and geographical work by these two Augustinians was fundamental for the establishment of the Spanish Empire in the Philippines, where they remained for more than three centuries. This episode is a clear example where science, religion and politics come together to justify the colonialism of a European empire in Asia during the modern era.

Andrés de Urdaneta; Martín de Rada; Philippines; 16th century; the problem of longitude

116. Adapting and resisting: the new ways of empiricism in Early Modern Iberia

Knowing and doing by 'Experience' in Early Modern Portuguese oceanic culture: An attempt of historical epistemology

Antonio Sánchez, University of Lisbon

This communication addresses the question of how, after the encounter with the novelty, the Portuguese navigators and cosmographers used the very notion of experience to delegitimize the classical science, creating a new way of doing science and legitimize the Portuguese colonial empire, spreading their rulers and society as a whole with a critical new mentality about the nature. My hypothesis is that in the Portuguese Renaissance the criterion of experience was adopted as the main criteria of truth, as a sine qua non condition for affirming and validating new knowledge. In Portugal, the category of experience took an increasingly sophisticated meaning, to the point that not only questioned the incompleteness and errors of Greco-Latin tradition, but also created a new notion of testimony credibility, authority and progress based on empirical practice and direct observation. To do this, I explore the relationship between history and philosophy of science through a paradigmatic case study regarding normative problems, this time related to the field of experience. This is part of a larger project which aims to be a double contribution to science studies. On one hand, it defends the general thesis of the historicity of epistemic categories from analysis of own scientific practices of the Portuguese colonial empire in the fifteenth and sixteenth centuries. On the other hand, it is intended to signal the emergence of a new way of doing science starring by social groups previously excluded from the world of knowledge at the time immediately before the Scientific Revolution. The aim is to combine methodologies and intends to use institutional archival data, cartographical sources and technical literature, published and manuscript, of this period.

Portugal, Experience, Historicity, Maritime Culture

Monsters? What Monsters? – Natural History is Normal History

Henrique Leitão, CIUHCT, University of Lisbon

An abundant mass of historical studies insists on the fact that the medieval and early modern european imagination was fascinated with monsters and the monstrous in nature. Indeed, monsters and the abnormal figure prominently in many narratives and in many books describing natural phenomena in this period. Historians have payed close attention to this fact and attempted interpretations of the role played by the extraordinary and the monstrous in early modern discourse about nature. Yet, when one reads the first reports of Europeans reaching new lands in the Americas, India or Asia, in the fifteenth and sixteenth centuries, one is immediately struck by the fact that monsters seem to be nearly absent. When they do appear their role is nearly always quite marginal and never the axis of the narrative flow. In marked contrast with literature that circulated in Europe, the first europeans that actually went to and saw the new places appear to be surprisingly uninterested in monsters, real or imagined. In fact, travellers attempting a description of the new lands seem to have faced quite the opposite problem: how to describe “normalcy” in the newly observed nature? How to convey the coherence and the stability of new natural scenarios, where animals and plants, although sometimes exotic and quite different from the ones in Europe, were, in a deep sense, very “normal”?

Natural History, Portugal, Spain

Sixteenth century Spanish navigation manuals and the challenge of standardization

Mauricio Nieto Olarte, Universidad de los Andes

Sixteenth century Spain, or better Seville, was the cradle of one of the major technological and political projects in modern Western history: The conquest of the New World.

Communication between sailors and cosmographers, between navigators and cartographers, or in a more general sense communication between explorers and the Crown, posed a very interesting epistemological problem. The solution lay in constructing a way of observing and gathering information according to a single unified framework. It was, therefore, necessary to standardize instruments and units of measurement, to train a disciplined group of navigators equipped for exploration and, of course, to ensure their return.

That was no coincidence that Seville was also the center of production of a number of texts, which combined classical cosmography with the new challenges of transatlantic navigation. More than a dozen of these navigation manuals intended to put together all the necessary knowledge for a secure navigation lead to an interesting combination of knowledge and skills in cosmography, astronomy, construction and use of instruments, ship building, the diverse tasks of sea men, artillery, and meteorology.

Sixteenth century navigation manuals are fascinating documents and no doubt important for the history of modern science. One could argue that they have a common and major challenge: standardization.

Standardization, navigation, Empire, modern science

117. Science, modernization and colonialism in the age of decolonization

Image and Possession

Catarina de Castro Laranjeiro, Centro de Estudos Sociais da Universidade de Coimbra
Daniel Barroca, University of Florida

We propose to reflect on the cinematography produced during the liberation war in Guinea-Bissau by analyzing how does it reify a modern notion of Nation-State, and therefore, exclude dissonant elements that jeopardize such narrative. In dialogue with the concept of phantasmagoria (Derrida, 1994; Gordon, 2008) and the sociology of absence and emergence (Santos, 2010) we will try to unpack how did the films produced during this period silenced narratives that wouldn't fit modernity's ideological structures. For the political leader of the liberation movement, Amílcar Cabral, science was the synonym of progress: "our culture must develop on a scientific base, it must be scientific, it must not believe in imaginary things" (Cabral, 1974: 141-142). However, in Guinea-Bissau, the land is inhabited by spiritual entities called *Irãs*. The dwellers have always made deals with the *Irãs* to assure good crops, heal diseases and solve conflicts. During the liberation wars those contracts allowed the warriors to become invincible. Although in western societies spirits are understood as metaphors of the invisible, in Guinea-Bissau when we speak of *Irãs* (spirits), we think of forces that have a tangible, therefore political, relation with the visible, basically, with the land. The claims for the land are always claims for social identity that thereafter are defined by a sense of property or belonging. In the context of the liberation war, the practices of the land associated with the spiritual culture were incompatible with the ideology of modernity defended by the liberation movements. To own the ability of seeing *Irãs* it's called *ter cabeça* (to have head) or *dupla visão* (double vision). Given the vision being the privileged sense of scientific knowledge, it is the one on which modernity is anchored. For us it is relevant to consider the implications of the hegemony of the visible and the consequent exclusion of the cultural expressions operating in the realm of invisibility. Yet, we come across various problems when we try to operate on the ontological level of the invisible. Thus, in addition to the ambiguities of the historical context of the liberation war and its memory, we intend to deconstruct the modern regime of visibility through the dialogue between moving images and *Irãs*. What we aim at is to make a parallel between the colonial history and the coloniality of images. How do we produce images and are possessed by images?

coloniality of images, cosmopolitics, liberation

Producing alternative views of colonial development: the Mission for Angola Agricultural Surveys

Cláudia Castelo, Faculdade de Ciências, Universidade de Lisboa

Scholars working the British and the French empires have already analyzed the ambiguous place of science in the era of decolonization and the competing concepts and practices of development in that context (e.g., Cooper 1997, van Beusekom 2000, Bonneuil 2000, Hodge 2011, Tilley 2011). Recent work has presented the Portuguese late imperial and colonial states as the institutional loci for a mixture between idioms, programs, and repertoires of: colonial social control and coercion; colonial development and modernization; and imperial and colonial social engineering (Jerónimo and Pinto, 2015).

Driven from that literature and using the "colonial archive" and oral sources, I intend to look closely to alternative views on the development of the Portuguese colonies that emerged within scientific and technical bodies of the imperial and colonial state in the postwar period, and understand the underlying processes of knowledge production, and the relation with trans-imperial and international trends. I will focus on the history of the Mission for Angola Agricultural Surveys (*Missão de Inquéritos*

Agrícolas de Angola, hereafter MIAA), a colonial technical body created in the early 1960s in response to a request from the Food and Agriculture Organization (FAO) of the United Nations to collect, compile, and analyse data on agriculture and agricultural holdings for the World Agriculture Census. The surveys were applied in the field by African collectors recruited from among the surveyed communities. MIAA did not only measure but it also understood the universe of survey. In a context of high anxiety for the political power, due to international anti-colonial pressure and the liberation struggle against the Portuguese rule, MIAA was called by the government to inform on colonial development policies regarding agriculture and settlement. MIAA's reports tended to contest the modernization model of Portuguese late empire (infrastructures, production increase and white settlement) and advocate different approaches to development of the "traditional" patterns of land use, farming and cattle raising, more attentive to Africans, their own knowledge and practices and their ecological interdependencies. MIAA's arguments were object of debate, tension and negotiation within the colonial state. Its valorization of African knowledge in order to improve the already existing systems, echoes today in FAO projects in Angola.

Angola; Agricultural science; Agricultural surveys; Colonial development; Portuguese Colonial Empire

Social Science, Modernization and Colonialism at the Centro de Estudos da Guiné Portuguesa (1946-1962)

Frederico Ágoas, CICS. NOVA-UNL

In Portugal, studies about the epistemic transformations observed since the mid-1950s in the context of colonial research, namely the incremental usage of social-scientific methods to produce information considered to be useful for the government of populations, has been focused in the activity of the Lisbon Colonial School (ISEU) or other bodies directly dependent of the metropolitan administration. Initially attributed to the initiative of some Portuguese Africanists, those transformations would in the meantime be regarded as by-products of the political reaction of the upper cadres of Portuguese colonialism to the radical transformation of the geopolitical context. More recently, it has been suggested that these transformations should be thought of in the light of the progressive rationalization of the colonial administration; the consequent reform of ISEU in 1946; and the appeals of the colonial cadres regarding their own professional training. Less explored, however, has been the importance of non-metropolitan initiative may have had in the same process.

It is in this context that it is important to explore the precocity of the cultural and scientific initiative of the Portuguese Guinea Research Center (CEGP), created in 1946, itself not restricted to the ethnographic or social research that will be regularly published in its journal, the *Boletim Cultural da Guiné Portuguesa* (BCGP), or in the Center's own editions. The substantive nature of these works, largely produced by colonial officers, is only marginally addressed in works that treat them as sources, and the activity of CEGP and its BCGP was only dealt with in works of a memorialistic nature or in studies centered on its main animator, the Navy Officer Avelino Teixeira da Mota, adjutant to the Governor of Guinea.

In this paper I synthesize the social-scientific activity of CEGP's early years in the broader framework of its cultural activity, and I integrate the results of this exercise in an overview of the reforms undertaken by Sarmento Rodrigues as Governor of Portuguese Guinea. The study of these initiatives is all the more relevant given that Rodrigues will in the meantime assume positions both as teacher of ISEU and as Minister of the Colonies and that the future leader of the nationalist movement of Guinea-Bissau and Cape Verde, Amílcar Cabral, will author several articles in the BCGP during the 1950s, at the time still as an agronomist at the service of the Portuguese Empire.

Colonialism; Social Science; Modernization; Guinea-Bissau; Portugal

Forging Social Sciences at the Global-South

Gabriela de Brito Caruso, IESP UERJ

This work aims to provide a historical analysis of the scientific development in the field of Social Sciences and demonstrate that its institutionalization in the colonies and former-colonies is one of the variables that help us explain our current international scenario. In other words, I seek to explain the massive presence of authors from the global-north and the sparse presence of global-southern authors in international literature circulating in the Social Sciences. This is not a matter of blaming the processes of colonization for that absence, but to investigate how this experience set common obstacles to the scientific development of countries that experienced colonialism or imperialism. Through the study of Social Science institutionalization in the periphery of the world, I seek to identify the influence of traditional knowledge centers in the direct transmission of scientific knowledge and teaching/researching techniques. Although sociology has developed and institutionalized itself in a specific way in each country, according to local conjunctures, there was a common need to meet the criteria of scientificity elaborated by the knowledge producing powers to be considered a legitimate academic subject. In order to produce knowledge globally, the periphery needed to produce science.

Amongst the various plans elaborated to professionalize and modernize higher education and scientific research, this work focuses on the Brazilian experience, electing the so called “French mission” at the State University of São Paulo since 1934 and the post-war UNESCO Project as a case study. To provide an alternative case in another spatial context, I also refer to the history of the social sciences in Southeast Asia and the influence of the Ford Foundation in the region in the context of the Cold War.

These experiences will be analyzed from the perspective of academic dependence, which identifies in some societies an intellectual dependence on ideas and resources of centers of excellence in the production of scientific knowledge. This article aims to analyze how the direct transmission of knowledge, techniques and resources of Europeans and United States centers has influenced the research agendas, areas, methods, and Social Science standards of excellence in the Global-South. I intend to contribute to the understanding of the obstacles presented to the internationalization of the Social Sciences of peripheral countries.

academic dependency, knowledge, social science, global-south

The peripheral effect: Sociological theory in Brazil in the 1950s and 1960s

João Marcelo Ehlert Maia, CPDOC

There has been much discussion about the relations between colonialism and modern science. In the case of the social sciences, many studies have been analyzing the effects of Eurocentrism and Empire on both theory and practice, as the recent collection organized by George Steinmetz demonstrates (Sociology and Empire, 2015). A renewed interest in dependency theory has also led to discussions on the center/peripheral relations that shape the modern economy of knowledge, particularly in sociology (Beigel, 2014; Keim, 2011). This paper builds on these recent discussions to present a case-study focused on the works of two sociologists who were active in the 1960s’ Brazil: Alberto Guerreiro Ramos (1915-1982) and Luiz A. da Costa Pinto (1920-2002). My goal is to analyze how their writings and working practices are affected by their peripheral location in the modern economy of knowledge. In order to do so, I elaborate on the concept of ‘peripheral effect’ as a key source of theoretical explanation.

colonialism; history of sociology; Latin American sociology; center-periphery relations

Race and Nation: notes about intellectuals, racism and colonialism in Haïti of 19th

José Renato de Carvalho Baptista, Instituto Nacional de Educação de Surdos

This paper try to provide an overview on the process of construction of the first post-colonial nation of the world, the Haïti, and the national intellectuality of this period. Our arguments are based in the problem bring since 1804, when a revolution place former slaves on control of the most important colony of the West. The Enlightenment's concept of humanity was not able to assimilate free black people from Haïti (Buck-Morss, 2000). So the haïtian intellectuality made enormous efforts to, at first, demonstrate the black people wasn't barbarians, but humans with the same capacities or habilities of the european man, challenging the racial theories from Gobineau. Particularly, our work focuses two of these intellectuals: Antenor Firmin e Louis Joseph Janvier.

Antenor Joseph Firmin is the author of "The Equality of Human Races: Positivist Anthropology" (1885), a very enormous contribution for the Anthropology and the Social Sciences from the nineteenth, presented in The Paris Anthropology Society. Firmin faced the racial theories and, in a way, contributed to laid the foundation of a modern social science in France, against the racist French Anthropology. Aside of Firmin, another intellectuals from Haiti was members of this Anthropology Society, as Louis Joseph Janvier who wrote two very important books, "The Equality of Races" and "The Haïti Republic and your visitors", who faced the scientifique racism and the bad image of Haïti on that time. The invisibility of the contribution of these intellectuals has much to say about the Western Social Science.

The efforts of these intellectuals are, particularly, a first production of a discourse against the coloniality in the terms proposed by Césaire (1955), and a legitime contribution for an Social Science produced in the Global South, before all the theories and the process of decolonization after the Second War.

Haiti; Intellectuals; Racism; Nation; Coloniality

Modernising Angola and Mozambique during the colonial wars: discourses, practices and road engineering at the service of the war effort

M. Luísa Sousa, Interuniversity Centre for the History of Science and Technology (CIUHCT) Dept. of Applied Social Sciences, Faculty of Science and Technology, NOVA University of Lisbon

An autonomous and better financed road agency in Angola (and, later, in Mozambique) was only implemented right after the beginning of the colonial war (or Independence war) in Angola, in 1961. It was called Junta Autónoma de Estradas de Angola (JAEA), emulating the name of the mother organisation in the Portuguese metropole (Junta Autónoma de Estradas, JAE). The JAE of the metropole had been created in 1927, during military dictatorship, and became the organisation that defined the road policy of the subsequent Estado Novo dictatorship.

This paper aims at arguing that the foundation of JAE Angola and JAE Mozambique and the related road policy of the 1960s were part of the Portuguese war effort in the Angola and Mozambique colonial wars.

We know that, in the 1960s, following the beginning of the colonial war, the investment in public works in the colonies increased substantially, not only in institutional, but also in financial terms. What we do not know is how the engineering in the colonies benefited from that and to what extent have the collaboration between civil and road engineering in the metropole and in the colonies been stemmed by these developments. By looking at the foundation of JAE Angola and JAE Mozambique and its main actors this paper aims at answering these questions. Furthermore, by using a history of technology approach, it aims at underlining the technopolitical agenda of these engineering

developments and how they were a less visible part of the war effort that aimed sustaining Portuguese colonial rule over those territories.

Portuguese late colonialism; Road Engineering; War effort; Colonial wars

118. Between Art and Knowledge: New Perspectives on Qing Scientific Drawings

Material and Measurement: Plate Glass and Planimetric Metadata in the Qing Palace

Lihong Liu, University of Rochester

Ever since crystal glass and its new technology were introduced to China in the seventeenth century, the production of glass at the court and in local furnaces reformed the chemical recipes and methodical procedures. The products supplied the court's needs for renovating window walls and interior decorations in the palaces. In these processes, meticulous records of productive procedures and measurements of plate glass for use became emblematic of the court's archival processing alongside blueprint design. This paper aims at bringing together a set of scientific, technological, and managerial practices unfolded in the production, storage, and use of plate glass in the context of Sino-European exchange. I argue that beyond numerical recording, measuring plate glass particularly exercised the notion of planimetric metadata, which pervaded cartography at that time; while the material nature of plate glass, with its flatness and clearness, crystalized such notion in its involvement and integration in artistic practice and architectural design.

Plate glass, material, measurement, planimetric metadata, China

A Global Flow of Anatomical Images: Skin in Chinese Art and Medicine

Tian S. Liang, University of Oxford

The discipline of anatomy, situated at the intersection of art and science, has been a well researched topic in the historiography of Western art. However, Chinese medicine is a complex and advanced system, but not predicated on anatomy, and the same goes for Chinese figure painting over the centuries. In Europe, the anatomist Andreas Vesalius's (1514–1564) embryonic work *De Humani Corporis Fabrica* of 1543 is one of the most influential anatomical books published in sixteenth century. Born in Brussels and trained in medicine in Paris and Padua, Vesalius never set foot beyond borders of Western Europe. However, the exuberant illustrations in the *De Fabrica* not only set the conventions of anatomical drawings for many centuries to come in Europe, but also reached China in the mid-seventeenth century.

In this period, both the knowledge and imagery of human anatomy were introduced to China by European missionaries via translated books, and within these books we find pictorial dissections of the human body that originated with the *De Fabrica*. Paying special attention to the (mis)depiction of skin (the delimitation between interior and exterior) in these translated anatomical books, and comparing it with the representations of skin in Chinese figure painting in the long eighteenth century, this paper is the first attempt to examine a conscious resistance to and reformulation of imported ideas of the body in China, so as to query how the body was scientifically assessed and artistically represented across paintings and printed images in early modern China.

Anatomy, figure painting, Chinese art, eighteenth century studies, medical books.