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ABSTRACT BOOK

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"A Place for Human Inquiry": Lomonosov's Mineral Science

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While polymath and first Russian member of the St. Petersburg Academy of Sciences Mikhail Lomonosov's research interests were famously broad, he began and ended his career as a mineral scientist. After initial study and work in mining science and mineralogy, he dropped the subject, returning to it only 15 years later with a radically new approach. This paper asks why Lomonosov went back to the subject and why his approach to the mineral realm changed. It argues that he returned to the subject in answer to the needs of the Russian court for native mining experts, but also, and more significantly, because from 1757 to his death in 1765 Lomonosov found in mineral science an opportunity to engage in some of the major debates of the Enlightenment. Through his late mineralogical writings, Lomonosov debated the role of religion in scientific inquiry, outlined a vision of science in service to the state, and defended the philosophical tradition of Gottfried

Leibniz and Christian Wolff against the attacks of French philosophes in the wake of the Great Lisbon Earthquake of 1755. This paper concludes by situating Lomonosov in a 'mining Enlightenment' that engrossed major thinkers, bureaucrats, and mining practitioners in Central and Northern Europe as well as Russia.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 18th century

"Atomic Spaghetti": Nuclear Energy and Agriculture in Italy, 1950s-1970s

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The presentation will focus on the mutagenesis program in agriculture implemented by the Italian Atomic Energy Commission (CNRN-CNEN), starting from 1956, through the establishment of a specific technological and experimental system: the so-called "gamma field", a piece of agricultural land with a radioisotope of Cobalt-60 at the center. The Cobalt-60 would emit constant radiation, primarily gamma rays, which would bombard the specimens planted in concentric circles around the source, inducing genetic mutations. The CNEN gamma field went into operation in

May 1960 at the Casaccia Laboratory, about twenty miles north of Rome, with a radiation device made available by the US Government for the Atoms-for-Peace program. Among the many research projects of the Casaccia Laboratory, the durum wheat program, strictly connected with the industrial production of Italian pasta, was particularly relevant. The extensive durum wheat mutation breeding work resulted in fact in the obtention of eleven registered varieties. In particular, “Creso” became the leading Italian variety with the highest percentage of durum certified and distributed seed. This presentation will analyze, first of all, how the American-Swedish experimental model of mutation breeding was translated into the Italian context, becoming instrumental for the modernization of Italian agriculture as well as for the establishment of plant genetics within the local academic system; secondly, it will describe how the FAO/IAEA network of durum wheat trials in the Mediterranean region contributed to the controversial diffusion of mutation plant breeding

technologies in the developing countries.

Technology | Europe | 20th century, late | Atomic science, Mutation breeding, Gamma field, FAO, IAEA

"Beginning of the Entomological Enterprise in China": Jiangsu Provincial Bureau of Entomology and Its Locust Control, 1922-1931

Yubin Shen

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Following the model of the Bureau of Entomology of the United States Department of Agriculture, Jiangsu Provincial Bureau of Entomology was founded in 1922 by western-trained Chinese entomologists with support from agricultural merchants, the provincial government and American specialists. As the first Chinese research institute and governmental agency responsible for pest control, Jiangsu Bureau played an important role in promoting applied entomology in China. This paper discusses origins and development of Jiangsu Bureau within such local, national, and transnational contexts during the 1920s and 1930s. What is more, by focusing on Bureau entomologists' locust control (in particular the case of adapting the Chinese traditional

practice of mobilizing ducks to eliminate locusts), my paper also examines how techniques of western applied entomology were introduced, practiced, modified, and innovated to meet Chinese realities.

Biology | East Asia | 20th century, early |
Entomology, China, scientific networks

"Despite the Asylum, Not Instead of It": Community Psychiatry in West Germany (1960-1980)

Chantal Marazia

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Germany

Histories of the German psychiatric reform usually identify the origin of this process with the so-called *Psychiatrie-Enquete*. The *Enquete*, published in 1975, consisted of a comprehensive report of the status quo and concrete recommendations for a structural reorganization of the West German psychiatric care system: community orientation; patient-centred care; coordination of all service institutions and providers; equal treatment and opportunities for the mentally and physically ill. The scholarship seems unanimous in highlighting the importance of some contemporaneous international developments as an intellectual and institutional blueprint for the German reform, especially the Italian initiative led by Franco

Basaglia. Some points of the 1975 reform program, however, had already been actualised in the 1960s, most notably some elements of community care. For example, the considered fruitful relationship between psychiatry and anthropology was to be tested on the grounds of community care. This paper considers two of these early instances, later taken as models: the *Zentralinstitut für seelische Gesundheit* (Central Institute for Mental Health) in Mannheim and the community psychiatry set in place in Mönchengladbach (NRW). The focus will be on their epistemological setting and their concrete solutions, such as day- and night-clinics, sheltered housings and patient clubs. Finally, we will discuss how far at the time and at the direct aftermath of the *Enquete* the international developments were mobilised as models for the national reform, or if the Germans tired of affirming their own tradition. This paper as been written by Chantal Marazia and Heiner Fangeru, Heinrich Heine Universität Düsseldorf

Medicine and Health | Europe | 20th century,
late | psychiatry, mental illness, anti-psychiatry,
deinstitutionalization

"Development" and Disarmament: The Twin Track of Pugwash in the Early 1970s

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Freelance writer

Arising from the 1955 Russell-Einstein Manifesto, the Pugwash Conferences brought elite scientists together across ideological divides to confront the dangers posed by nuclear weapons. Powered by ideas about scientific social responsibility and claiming political neutrality, Pugwash developed an approach to disarmament based on the shared language and methods of science. Meeting annually from 1957, Pugwash facilitated east-west communication and rapidly developed as a forum for Track II diplomacy. The object of official suspicion on both sides of the bloc divide, Pugwash nevertheless established a global reach and carved out a distinctive niche within the Cold War nuclear nexus. Its work towards nuclear disarmament was recognised with the 1995 Nobel Peace Prize. By the 1970s, the changing geopolitical dynamics and increasingly global character of the Cold War presented profound challenges for Pugwash leaders. The onset of détente and arms limitation treaties, while welcomed by

Pugwash, simultaneously served to weaken it. This paradox created new challenges: the changing array of global threats to peace meant Pugwash had to adapt to remain relevant to state actors. Important here was a deepening engagement with the North-South divide and the problems of the 'developing world', although Pugwash remained vigilant to the nuclear threat, including within this region. This paper explores this transition from two analytical perspectives: focusing on the narratives of senior Pugwash figures it assesses its effects within the organization. Using India as a case study, it examines the political conflicts encountered by Pugwash in its work in the Global South in the 1970s.

Thematic Approaches to the Study of Science |
Global or Multilocational | 20th century, late

"Ideal Specimens": Butterfly Nature Prints, Entomology, and the Decorative Arts in Early 20th Century Japan

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Planck Institute for the History of Science

This paper examines the materiality and functions of butterfly nature printing, so called lepidochromy, in early 20th-century Japan. This technique complicates the

relationship between specimen and image as well as between entomology and the decorative arts, but has to date remained on the margins of scholarly attention. In lepidochromy, the colorful scales that form the patterns of butterfly wings are transferred to paper or other materials, while the insect body is drawn in by hand, producing specimen/illustration hybrids. The Nawa Entomological Institute in Gifu, a small semi--public institution otherwise focused on research into agricultural pests and other aspects of applied entomology, patented a specific lepidochromy technique and built a workshop to manufacture large numbers of prints. These were used to make books and cards, marketed to researchers and educators as “ideal specimens”, as well as decorative arts such as paper fans, silk kimono belts, or umbrellas. The products, which mainly made use of butterflies collected in colonial Taiwan, were sold in Japan and Europe. The paper will show how the images were seen to serve both epistemic and aesthetic purposes: As an easily mobilized and durable form of specimen, they were produced for research and educational functions in a time of exponentially growing insect

collections. As a mass--- producible and yet individualized form of illustration, they also fit the contemporary market’s demand for Japanese decorative arts and authentic representations of nature. Through these activities, the institute also expanded, as the paper argues, its definition of applied entomology.

Biology | East Asia | 20th century, early |
Entomology, Japan, Decorative Arts,
Commerce

"Journalization" of Science Publishing: Periodicity of Book Formats at Springer, North-Holland, OUP, and Interscience, 1950-1965

Alrun Schmidtke
Humboldt-Universität zu Berlin

While recent scholarship on the history of science publishing has focused on scientific journals, self-confessed ‘journal publishers’ only came into being in the latter half of the 20th century. This poses the question how this shift towards periodicals as core products was brought about: What other formats were publishers invested in and how did these formats relate to periodical publishing? Why and how did this change? This paper explores publishers' perspectives on scientific publication formats in the mid-20th century as mediated by publishing

adviser Paul Rosbaud (1896-1963), who worked for several publishers such as Springer in Germany, North-Holland in the Netherlands, Interscience in the U.S., Oxford University Press and Pergamon Press in the UK in the 1950s and 60s. During this period, Rosbaud, a trained physical chemist, was involved in a plethora of publication projects. This included the founding of new journals, the publishing of conference proceedings, textbook series and handbook literature. Most of these formats held some promise of periodicity to the publishers: Even if publications like textbooks and handbooks are not commonly associated with periodical publishing, they could exhibit such features from a sales and distribution point of view. Drawing on rich sources from publishers' archives and Rosbaud's lively correspondence with leading physicists as preserved in their personal papers, this paper traces negotiations between scientists and publishers in regard to an ongoing 'journalization' of science publishing in the mid-20th century.

Aspects of Scientific Practice/Organization | Global or Multilocal | 20th century, late | science publishing, publishing formats, journalization

"Measuring Instruments" for Language History: Rhetoric and Reality of a Nineteenth-Century Latinist

Christian Flow
Mississippi State University

Crowning the career of the Munich Latinist Eduard Wölfflin (1831-1908) was his role in founding the *Thesaurus linguae Latinae*, a massive lexicon that aimed to deliver an unprecedentedly complete history of the words it treated. The work, begun in the 1890s and still in progress today, is a standard research tool for philologists. For Wölfflin it represented a breakthrough after decades developing and promoting his historical-lexicographical agenda, often by analogy with the work of investigators in other arenas. Philologists, Wölfflin said at various times, were to use a kind of "microscope," were to observe like foresters, were to develop "their own measuring methods and instruments" like the researcher of nature. He invoked meteorology, statistics, biology. Rhetoric only? Perhaps not. A close look at Wölfflin's practices helps to clarify his comparanda and suggests that he did indeed see himself engaged, in some cases, in a parallel enterprise to those studying

natural phenomena. At a certain level, philologists really did work like forestry researchers. This paper shows how.

Thematic Approaches to the Study of Science

"More French Than the French": John Herschel and Musical Standardization in Nineteenth-Century France and Britain

Edward Gillin
University of Cambridge

Between 1858 and 1859, Emperor Napoleon III's government determined a national pitch to which musicians should tune their instruments. The following year, the British Society of Arts attempted to emulate this standard. Amid tense Anglo-French relations, however, British audiences interpreted the French pitch as a measure of the country's political autocracy. As a result, British mathematicians attempted to mobilise nature itself as a resource in redefining what musical standard Britain should adopt, but this raised profound concerns over the cultural authority of those with scientific credentials. Through the controversy of standardizing musical pitch during the 1850s, this paper explores how these ambiguities over cultural authority shaped disagreements

between instrument makers, musicians, and mathematicians. From the late-1850s, discussions over the regulation of musical pitch revealed that while natural philosophy and mathematics might provide acoustic knowledge, they could exert little influence over music itself. For musical practice, standardization, that most essential of Victorian scientific concerns, remained firmly in the hands of musical communities. Pitch was, in effect, the measure of science's limits. While controversies over standards for electricity, heat, and time were resolved in the laboratory and observatory, a standard for music remained elusive. Despite John Herschel's campaign for a standard C of 512 vibrations, which he claimed had mathematical credentials, it was Britain's musical elites who determined how the nation's music would be ordered.

Physical Sciences | Europe | 19th century | Measurement, standards, sound, music, mathematics, Herschel, instrumentation, politics, Victorian

"Nations Can Publish or Perish"? Scientific Metrics and Development

Alex Csiszar
Harvard University

After World War II, as science became attached to the discourse of international development, analyses of the scientific literature became a key source for producing national comparisons of scientific productivity. This paper will focus on the rise of the Science Citation Index and will suggest that the uptake of this new tool was connected as much to its applications to producing measures of scientific productivity as to its use as a literature search tool. Today it is clear that tools for measuring science are political as much as they are technical. By operationalizing universalist concepts such as quality and significance, they are means by which to legitimate or marginalize particular national research collectives. Historical accounts usually imply that the rise of science metrics and their application to policy was a natural consequence of new technologies for the automatic collection, manipulation, and distribution of publishing data. But it also depended on contested ethical and sociological claims about public

and private communication, access to scientific findings, and the role of the scientific literature in the global circulation of knowledge largely articulated by scholars based in the United States. This paper juxtaposes the claims of advocates such as Derek de Solla Price and Robert Merton with early critics outside the USA such as Edmundo Fuenzalida and later Léa Velho whose work began to show that there was a geopolitics to scientific authorship, reading, and citation that problematized their infrastructural role in accounts of the universality of science.

Aspects of Scientific Practice/Organization | Global or Multilocal | 20th century, late | scientometrics, sociology of science, development, global science, information technology, book history

"Off Alone on My Tramps": Correspondence Networks of Women Botanists in the U.S. Frontier West

Tina Gianquitto
Colorado School of Mines

This paper will explore the correspondence of women botanical collectors in the U.S. Frontier West and will discuss the hidden histories of women's scientific work taking place in the nation's mining, mountain, and border outposts.

Letters exchanged both between women in the West, and between these women and their eastern, generally male correspondents, demonstrates the range of motivations, hazards, rewards, and sacrifices that prompted women such as Alice Eastwood (1859-1953), Sarah Plummer Lemmon (1836-1923), Mary Katharine Brandegee (1844-1920), Rebecca Merritt Austin (1832-1919), and Emily O. Pelton (c.1858-1945) to pursue plants across remote landscapes. This paper will investigate the degrees of candor with which these women talked both to each other and to those outside their close circles about issues we would now classify as sexual harassment, pay equity, and professional advancement.

Thematic Approaches to the Study of Science | North America | 19th century | Botanical History, Gender, Women, Correspondence, Material Culture, Sexual Harassment, Pay Equality, Professionalization, U.S. Frontier West

"Science is the Antichrist": Popular Science, Radicalism, and Irreligion in Early Nineteenth-Century Britain

Eoin Carter
University of Cambridge

In 1820 the radical journalist Richard Carlile declared in the pages

of his 'Republican' that science had for centuries been "continually at war" with religion. While historians have tended to locate the conflict thesis as the product of debates much later in the nineteenth century, in this paper I show how a militant, scientifically-inflected irreligion was a recurrent feature of radical agitation in Britain as early as the 1820s and '30s. What marked Carlilean radicalism out as novel was his recruitment of science as the key vehicle for his proposed programme for the popular overthrow of Old Corruption. As well as science providing the intellectual ground for his materialist doctrines, scientific education would also, through new organisations like the Mechanics' Institutes, act as the means of liberation of the working-class mind. Carlile was joined in his struggle by his 'moral wife' Eliza Sharples (whose short-lived 'Isis' made her the first woman to edit a radical paper in Britain), as well as a cadre of itinerant lecturers, including the 'infidel astronomy' of his friend the Reverend Robert Taylor. Meanwhile, new Zetetic Societies emerged as a freethinking rival to elite provincial literary and philosophical societies. In other words, Carlilean science offered an

active intellectual programme to the disaffected artisans of Britain. As well as deserving attention in its own right, greater awareness of this radical counterprogramme is essential in assessing the knowledge politics of other, more familiar modes of popular science in this period.

Thematic Approaches to the Study of Science | Europe | 19th century | Politics of Science, Science and Religion, Popular Science

"The Easy Transmutableness of Water": The Alchemy of Seed Steeps and "Fructifying Waters" in Seventeenth-Century English Agriculture

Justin Niermeier-Dohoney
University of Chicago

Johan Baptista van Helmont's famous willow tree experiment purported to demonstrate that "164 pounds of wood, bark, and roots had come up from water alone," suggesting the preeminence of water as the foundation for botanical growth. This experiment has a long afterlife among agricultural reformers in seventeenth-century England, but rather than accept water as the sole driver of the development of plants, many of these reformers adopted various alchemical techniques designed to determine what discrete substances

within water conveyed fertility. In the process, they explored the nutritive properties of substances such as alum, quicklime, natron, distilled water, blue vitriol, potash, vitriolic acid, verdigris, copperas, and all manner of salts, and created mixtures of numerous, sometimes secretive substances often called "fructifying waters," among many other things, as liquid solutions in which to steep seeds or use as pest control for crops. In this presentation, I argue that these reformers incorporated these chymical substances normally associated with alchemical laboratories and apothecaries into agriculture and aqua-culture. Their goals were manifold: they sought to improve agricultural yields, increase the quantity of viable seeds and alleviate the risks of poor harvests, and develop marketable and sometimes patentable recipes for profit. In the process, they added to the growing body of knowledge about the function of seed growth, the lifecycle of plants, and the relationships between plants and soil, water, air, and fertilizers. They also sought to answer two of the knottiest questions in botany—what

caused seed germination and could this be controlled?

Chemistry | Europe | 17th century | alchemy, agriculture, plant science, environmental history

"The Most Noble of All Commodities": Mineral Trade and the Earth Sciences in the Early Modern World

Claire Conklin Sabel
University of Pennsylvania

Mineral commodities were an important topic of inquiry in early modern earth sciences that have largely been overshadowed by debates over the age of the earth. Besides fossils, many other minerals stimulated profound questions about the earth's material composition and provided evidence for theories of matter formation and the distribution of valuable commodities. The trade in precious stones between Europe and Southeast Asia offers one slice through the seventeenth century's global trade in minerals that included gunpowder, dyestuffs, and many other materials destined for a wide range of artisanal and industrial applications. This flashtalk will situate gemstones in seventeenth century natural philosophy and commercial networks across the Indian Ocean. I argue that the trade routes that

linked these two domains of activity reveal an underappreciated preoccupation with precious minerals in early modern earth sciences.

Earth and Environmental Sciences | Global or Multilocal | 17th century | trade, minerals, commodities, cross-cultural exchange, gemstones

"To Study What Is Ours": Scientific and Political Representations of Africa in the Lisbon Zoological Museum, 1862-1881

Catarina Madruga
CIUHCT, University of Lisbon

Between 1862 and 1881, the director of the Zoological Section of the Museu Nacional de Lisboa, José Vicente Barbosa du Bocage (1823-1907), launched and consolidated a research program to study national fauna supported by the addition of new collections. The characteristic fauna of Portuguese land and seas should no longer be unknown in the rest of Europe neither misrepresented in the existing national collections. The scope of the national fauna considered metropolitan territories as well as imperial possessions and, according to Bocage, all of these geographical regions should be studied by "our own" instead of foreign naturalists

and explorers. Lacking the resources of larger museums, Bocage leaned on the individual participation of collaborators both at home and distributed along the many distant outposts of the Portuguese empire. The nationalistic tone set by Bocage gradually yielded results and the work with the new collections allowed for an active new museum which in turn enabled the publication of tens of new species, with a particular emphasis on Angolan vertebrate fauna. The descriptive taxonomic work in the Lisbon museum relied on local information, indigenous names, and specimens gathered from Portuguese colonial officials and collectors on the field. This paper considers this particular form of taxonomic and zoogeographical knowledge as a political field that substantiated the national rhetoric of appropriation and justification in the construction of the Portuguese African empire.

Thematic Approaches to the Study of Science |
Global or Multilocational | 19th century | Natural
History Collections, Museum Studies, Material
Culture, Scientific Expeditions in Africa, Science
in the Portuguese Empire

"We need to talk about Richard Owen"

Daniela Sclavo

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of London

The historiography of Richard Owen has focused on certain aspects of his character; from his difficult personality, rivalries, keenness on power to his museum enterprise and his standing-point on transmutation. However, an integral understanding of him still lacks in the literature. More specifically, of his years in the Royal College of Surgeons (1827-1856) – a period that remains in the shadow of Darwinism. In this work, Moral Economy is used as an analytical tool to illustrate the non-monetary resource management that Owen undertook in a specific social context in order to achieve his ambitions of institutionalising the field of Comparative Anatomy and being Britain's most eminent naturalist. Through the study of Owen's growth and expenditure of socio-political, intellectual, and emotional capital, a more humane and neutral portrayal of this controversial figure is exposed. As a little-explored arena, the former is particularly discussed. Owen's historiography has focused

particularly on his professional correspondence with men. However, Owen's personal letters to his wife, mother and sisters reveal a different emotional expression. In that sense, Owen's emotional capital touches on how his intimate relationship with his family provided a space where he privately curated his other capitals and how this had a direct impact on his professional development. Together with an analysis of his socio-political and intellectual capitals, this paper offers a synthetic approach where single behaviours are not over-interpreted, but normalised. Therefore, it challenges the long-held vision of an overwhelmingly defensive and power-centred naturalist.

Aspects of Scientific Practice/Organization | Europe | 19th century | Richard Owen, Moral Economy, Social Capital, Political Capital, Intellectual Capital, Emotional Capital, Professionalisation of Science

"When I Saw It, I Began to Scream": Discovery and Loss in the Visual History of Human Embryology

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HPS, University of Cambridge

"When I saw it, I began to scream." Thus Miriam Menkin recalled her reaction, at the Free Hospital for Women in Brookline, Massachusetts

in 1944, on observing what she believed was the first human egg ever fertilized in vitro. "Shaking like a leaf," she "felt like—who was the first man to look at the Pacific—Balboa?" Such a precious specimen as this "beautiful two-celled egg" called for an elaborate preservation procedure—but in the process, Menkin lost the embryo for ever. She and her boss John Rock "came to think of it as the first miscarriage in vitro." The talk will place this distinctively gendered account of discovery and loss alongside others from the history of human embryology since the eighteenth century. It will analyse researchers' emotional relations to visual objects they valorized as among the greatest treasures a scientist could own, and stored in vaults and safes. I shall suggest that, while discovery accounts of human origins tended to invoke tropes of the sublime, tales of loss stress the difficulty of working with tiny, fragile materials and the worth of what was saved. That could be either drawings or photomicrographs of the mislaid object or replacement preparations. Yet specimens were lost not only physically, but also through their reclassification as abnormal or artefactual—many later specialists'

opinion of Menkin's. Knowledge of further analysis and future recognition has selected and coloured those stories of visual encounters in which the apparently spontaneous expression of emotion serves as a marker of authenticity.

Thematic Approaches to the Study of Science | North America | 20th century, early | Images, emotions, observation, discovery, loss, human embryology, in vitro fertilization

"Whenever the Rules... Should Fail, and Grow Tedious": On the Limits of Perspectival Representation

James Clifton

Sarah Campbell Blaffer Foundation

In one of the six perspectival projections in *The Practice of Painting and Perspective Made Easy* (1756), Thomas Bardwell includes an ancient sculpture of an elaborately curved pair of ram's horns. His long study of the rules of perspective and "puzzling after this mathematical Truth" notwithstanding, Bardwell was unable to render the form of the horns mathematically and determined that "whenever the Rules . . . should fail, and grow tedious, . . . I design immediately to settle the Affair at Sight of the Object." Mathematicians who wrote on perspective acknowledged the

complexities of perspectival rendering and described mechanical devices to aid in avoiding the difficulties for those who were not "willing to take the pains to open the Compass, nor to take the Rule for to draw a line," as Jean Du Breuil put it in 1642. Such devices were ingenious alternative responses to the challenge of rendering two-dimensional objects on a three-dimensional surface and themselves reached considerable levels of complexity, but the extent to which they were actually used by practicing artists remains unclear. This paper examines the tipping point between perspectival theory and practice, focusing on renderings of curved objects, especially musical instruments, from Albrecht Dürer's famous woodcut of two artists using a device to depict a foreshortened lute in his *Unterweysung der Messung* (1525) to the elaborate still lifes by Evaristo Baschenis and Bartolomeo Bettera in the next century.

Theoretical Approaches to the Study of Science | Europe | Renaissance

“An Ethnographical Museum of Living Specimens”: Retelling the Social and Scientific Life of the Schlagintweit Expeditions in Asia in the Mid-1850s

Moritz Von Brescius
University of Bern

The recurrent denial of indigenous agency and ambition in schemes of European explorations strongly suggests the need to overcome the myth of western solitary travellers by taking a new and multi-perspective look at the inner life of expeditions. This paper analyses significant facets of the programme launched by the three Schlagintweit brothers in and beyond the East India Company (EIC) realm in South Asia. Their enterprise is significant not least for the vast quantity of materials and documents it accumulated and the ambiguous relationship it maintained throughout with its main sponsor, the EIC, and other agents and patrons of imperial and European sciences. The mission offers rich opportunities for the historical examination of major themes in the study of imperial knowledge, changing scientific practices and of transnational and cross-cultural engagement. Against the existing literature, I squarely place the

Schlagintweit expeditions into their colonial context by exploring how their ambitious survey programme of physical geography, climatology, soil science and ethnography depended heavily on the mobilisation of the colonial infrastructure of British India, including its technical services, prisons, hospitals and imperial knowledge networks. The paper closes by analysing how the German travellers sought to both acknowledge the vital role of indigenous participation and instruction in their enterprise in published accounts, and the brothers' simultaneous attempt to maintain their own authority as supposed 'leaders' in front of European audiences by portraying their South Asian companions as reliable and calibrated but ultimately inferior 'instruments' in the execution of their large-scale mission.

Aspects of Scientific Practice/Organization |
South Asia | 19th century | British India,
Indigenous knowledges, field sciences,
European colonialism, social structure of
expeditions

A Global Rumor and the History of Science: The Case of a Fake Snakebite Prize That Connected Brazil, the French, and the British Empires (1880-1914)

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Sciences Sociales

Informed by the recent achievements of bacteriology, doctors and scientists started researches on the last decades of the 19th century aiming to find a therapeutic serum against snakebites. Among them, one can mention Albert Calmette, a French doctor in duty in Indochina, and Vital Brazil, a Brazilian doctor based in São Paulo. Other than the similarity of their intellectual projects, they had another point in common: both thought they could win a scientific prize established by the Government of India for the discovery of a cure against snakebites. Working on antidotes for more than 20 years, Calmette and Vital Brazil would indeed answer the general idea of the prize and their contributions to the field are recognized until today. However, neither of them ever won this prize, and that happened for a simple reason: this prize never existed, it was a rumor of global dimensions. In my presentation, I would like to examine its origins and to discuss

how it shaped the research of these two doctors. To do this, I will examine their scientific works and their correspondence with British and Indian authorities. In conclusion, I will argue that, in despite of its fakeness, the prize connected people in Brazil with others based in the French or British Empires and, because of that, this event can shed some light on current debates on the field of the history of science, especially on its interactions with the global history approach.

Medicine and Health | Global or Multilocational |
19th century | Global history of science,
Empires, Medicine

A Hero's Counsel: Communist Climate Policy at the 1979 World Climate Conference

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Manchester

The paper explores the intellectual and ideological underpinnings of Evgeny Konstantinovich Fedorov's pronouncements on the future of communist climate policies during his 1979 plenary at the World Climate Conference (Geneva). Fedorov (1910-81), a Hero of the Soviet Union and Stalin Prize winner, was a Russian geophysicist, polar explorer, academician and

Director of the Soviet Hydrometeorological Service. He led the Soviet delegation at the Geneva conference during which he made a salient intervention in contrasting communist and free-market approaches to climate change policy. In his view, only socialist societies based on intrinsic human values could provide basis for a policy that protected human dignity, international peace and the environment. This position has origins in Fedorov's 1972 *Man and Nature*, in which he presented a Marxist environmental perspective in agreement with the conclusions of the Club of Rome's *Limits to Growth*. For his plenary at the Geneva World Climate Conference, Fedorov additionally drew on Ervin Laszlo's *Goals for Mankind* (prepared for the Club of Rome in 1977). Laszlo argued for 'breaking of inner limits' and for 'a world Solidarity Revolution,' which Fedorov thought was central to any criticism of the Western hypocrisy towards the environment and for his own – and the Soviet – politics of climate change. In bringing to light this critical, if ultimately misguided position, this paper hopes to contribute to a more granular history of the pre-1980s thinking about

climate change and climate change policy that includes voices that so far have received less visibility among historians of science.

Earth and Environmental Sciences | Europe | 20th century, late | EK Fedorov, Climate Change, Soviet Union

A Language for National Development: The Computer Literacy Program at Starehe Boy's Centre and School, 1980-1990

Ray Thornton

PhD Student, Princeton University

In 1980, Starehe School in Nairobi became the first Kenyan second-level institution to introduce computer education. From a small pilot-scheme reliant on the University of Nairobi's mainframe computer, Starehe's program expanded rapidly. Student enthusiasm and an ambitious school leadership convinced international donors to provide mini-computers and construct a computer laboratory. Starehe soon became Kenya's strongest advocate for the adoption of computer technology, with visits from the President, Daniel Arap-Moi, and local and international business and NGO leaders. Indeed, Kenya's present status as a technology hub in east Africa has often been attributed to Starehe's

early experiment in promoting computer literacy. With Starehe's computer education program as its central focus, this paper sheds light on three interlinked aspects of the adoption of technology in Kenyan history. Firstly, at the level of the school, it explores the significance of technology education as a form of pedagogy, building on work in gender and sexuality studies that considers how computer environments have been constructed as masculine spaces. Secondly, it considers the role of the school in shaping, and responding to, national debates around technology policy in a Kenya (at least at the government level) that was initially reluctant to see the widespread adoption of computer technology. And finally, in a school that was designed to promote national development, it explores how computer literacy was cast as a means to rapid growth in an era of economic stagnation.

Technology | Africa | 20th century, late | technology adoption, pedagogy, Kenya, computer literacy

A Mantra for Elephants: Religion and Animal Modernity in Early Modern Malaya

Faizah Zakaria

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This article examines the text and context of elephant mantras used in shamanic modes of healing in early modern Malaya to elucidate an historical ethnography of the relationship between humans and elephants. It offers a methodological intervention in terms of how such sources can be read as well as a historiographical argument that complicates notions of animal modernity more broadly. How does reading the human-elephant relationship through the lens of religion open up new spaces for seeing and sensing not just the Malaya's environmental past but also the ecological power of conversation with the spirit world? Two key points are highlighted. First, continuous anxieties over the potential power of the elephant were reflected in a pathological characterization of untamed elephants. The quasi-colonial relationship over captive animals that resulted from these anxieties disrupts the prevailing view that British imperialism in Malaya marked the beginning of modernity.

Second, cross-cultural contact evidenced by linguistic sedimentation of these mantras - mixing the Malay and Siamese languages - brings to view the role of religious conversion in domesticating these anxieties through a performance of anthropocentric power.

Thematic Approaches to the Study of Science | Southeast Asia | Cultural and cross-cultural contexts, including colonialism in general

A Musical Story of Time 🎵

Susanna Bloem

We struggle with time! Popular lines like: “do things in your own time”, “time heals all wounds”, “live in the here and now”, suggest that time is important to the way we live our lives in the 21st century.

Simultaneously, these wisdoms have a history. Without knowledge of this past such statements turn into empty and meaningless clichés, not applicable in life and not usable in debate. Therefore: we have to know what time does to us and, vice versa, what we do to time. Susanna Bloem’s project, entitled ‘Time and person, now?!’, aims to uncover ideas about time-experience from the modern history of psychiatry and does that via research and composition. After all: there is no

better way to start talking about the meaning of time than via an experience of time through music. Since music can make time concrete. Tonight she will play and talk about her first piece “Human time”: Which treats “Inner life history” a psychiatric concept of the first half of the 20th century. She invites you to listen along and investigate with her how music can help to describe past ideas about the psychic forms, possibilities and limitations time can take. And this way inform the question: What is the relationship between time-experience and a meaningful life?

Tools for Historians of Science

A Note on Tone: Carl Stumpf’s Tone Psychology and the Violin

Julia Kursell

University of Amsterdam

This paper tackles philosopher Carl Stumpf’s contributions to founding the discipline of musicology from the vantage point of his musicianship. In an autobiographical essay of 1924, the philosopher and experimental psychologist wrote that he had considered becoming a professional violin player before taking up the study of philosophy. Against this background, the paper examines some of the writing

strategies that Stumpf applied in his quest to capture the features of musical sound. It focuses on Stumpf's on the term "tone" as he used it in the early days of the journal *Vierteljahrsschrift für Musikwissenschaft* (founded in 1885)—that is, the period between the publication of the two volumes of his magnum opus *Tonpsychologie* (1883–90).

Tools for Historians of Science | Europe | 20th century, early | History of humanities, psychology, musical instruments

A Science without Nature in China: Heaven (Tian), Morality, and Darwinian Competition from 1890 to 1923

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An intriguing, but little noticed, puzzle exists in the historiography of science in modern China: While Tianyanlun (On Heavenly Evolution), the Chinese translation of Thomas Huxley's *Evolution and Ethics*, is widely celebrated as THE most influential book in modern Chinese intellectual history, it received little credit in the history of science. Taking this puzzle as a clue, this paper argues that the publication of Tianyanlun by Yan Fu in 1898

was a watershed event since it popularized a distinctively novel vision of Western science. As indicated by the Chinese title, Tianyanlun addressed the key concerns of Chinese literati, showing that the Chinese have failed to comprehend the “Way of Heaven (Tian),” namely, competition. In order to connect science with Tian, the “cosmic foundation of morality,” Yan Fu strategically downplayed the Western notion of “nature” throughout his book. When the May-4th intellectuals in the 1910s endeavored to replace Yan Fu's “science without nature” with a more radical, modernist vision of science, they strove to “naturalize” the notion of Tian. Following their lead, historians thereafter have dismissed Tianyanlun as not truly a work of “natural” science but merely “social” Darwinism. By way of situating this foundational text/event in the context of science, this paper shows how the history of science can offer insightful and fresh perspectives on issues crucial to modern Chinese cultural and political history, such as the emergence of “the natural” and “the social” (as actors' categories), the transformation of Tian, and the

contentious relationship between science and morality.

Thematic Approaches to the Study of Science | East Asia | Cultural and cross-cultural contexts, including colonialism in general | Science in China, Tian (Heaven), Ethics, Yan Fu, Darwinism, Competition, Moral Authority of Nature

A Selenography in New Spain: Colonial Strategies for Mapping Local Knowledge

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Universidad Nacional Autónoma de México

In 1770, a Mexican criollo naturalist and antiquary, Jose Antonio Alzate, published the first selenography in the Americas: this map of the moon was a small engraving inserted at the end of a pamphlet entitled *Eclipse de Luna*, dedicated to Charles III of Spain. The print was a copy of a widely circulated lunar image popularised in the annual ephemerides *La Connaissance du Temps* (promoted by the French Académie des Science) and it was intended to illustrate an astronomical observation that would correct the position of the Mexican Meridian in a world map. This work was sent to Paris alongside natural and geological specimens, maps of Mexico and other written reports. In this way, astronomical observations were meant to locate or relocate

material evidence for the description of an unknown territory, as well as promote local science. In this paper I argue that Alzate's mapping practices (based on the connection between practices for determining longitude and the description of the Mexican territory through the making of natural collections) do not just bring to the discussion another case of colonial appropriation of visual and material strategies for establishing local authority in international contexts: this instance also brings attention to the relationship between naturalism and astronomy in late eighteenth-century debates about temperament and race.

Theoretical Approaches to the Study of Science | Latin America | 18th century | lunar map, Mexico, colonialism

A Shared Enterprise of Knowledge: Ottoman and European Scholars on Experience and Revising Knowledge

Duygu Yildirim

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In the seventeenth century, a particular sort of early modern scholarship arose that privileged experience in integrating foreign sources of knowledge both in European and Ottoman contexts. These early modern scholars

expounded the idea that a certain truth can be reached through conversations among individuals across religions, only if each person was engaged in the shared enterprise of trying to understand nature through experience. This paper explores the working methods that these Ottoman and European scholars adopted for a more informed scholarship on both Islamic and Western civilizations. I trace how the shared preoccupation with revising knowledge made fruitful scholarly communication possible on both sides. In revising scholarship on natural history and medicine, naturalists and physicians incorporated expertise of scholars of Oriental languages and historians as well. This select group of scholars found themselves engaged with what it means to seek knowledge that could rise above the specificity of time and place, that would truly become universal by incorporating elements of foreign knowledge into a new kind of early modern encyclopedia. While cultural empathy was at stake in structuring this community, knowledge exchange became possible only when European and Ottoman scholars used similar scholarly methods in their own works. They

selectively chose materials conducive to their approach and intent. In a paradoxical way, shared scholarly methods in experience structured cross-cultural scholarly interactions on the eve of modernity.

Thematic Approaches to the Study of Science | Near and Middle East | 17th century | Experience, Ottoman, physician, networks, universal knowledge, natural philosophy, medicine, cross-cultural, knowledge exchange

A Standardized Vernacular or a Vernacular Standard? The Position of Swahili in the Early Twentieth Century

Morgan Robinson
Mississippi State University

This paper explores a 1925 meeting in Dar es Salaam, Tanganyika, during which the British colonial administrations of eastern Africa agreed upon the dialectical basis for Standard Swahili. If examined from the standpoint of the 1920s, this decision seems a typical story of imperial appropriation and imposition, a moment in which the colonizer decided what language was ‘best’ for the colonized. By placing this decision in the context of the longer social and intellectual history of Standard Swahili, however, we can see that it is just one pivot of many between ‘vernacular’ and ‘official’

knowledge production—a process that had taken place over the course of many decades, and that would continue for many decades to come. Building upon the idea of ‘linguistic ecosystems,’ the paper brings to the fore the host of interlocutors involved in the lead-up to 1925 and its reverberations across the region. Exploring this single shift between ‘vernacular’ and ‘official’ knowledge production sets us up to understand how quickly proponents of the latter (in this case, the British colonial regime) lost control of the process. Over the course of just two decades, Standard Swahili, once a tool of colonial rule, became the language of Tanganyikan nationalism and independence. Even more importantly, the paper demonstrates how ‘vernacular’ and ‘official’ knowledge production often work in tandem, arguing that they can be mutually constitutive.

Social Sciences | Africa | 20th century, early | linguistic ecosystem, linguistics, Standard Swahili, East Africa, vernacular knowledge, official knowledge

A Variety of Futurologists: "Feminist" Speculative Fictions in the Wake of the Pill

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Harvard University, History of Science

Clustering around the introduction and proliferation of the birth control pill in 1960 U.S., I present a cultural history of this invention’s enduring consequences for the liberatory imagination through an intertextual conversation between an unexpected trio: science fiction novelist Ursula Le Guin, radical feminist Shulamith Firestone, and the Pill co-inventor Carl Djerassi. This talk explores three of their experiments—Le Guin’s 1969 novel *Left Hand of Darkness*, Firestone’s 1970 manifesto *Dialectic of Sex*, and Djerassi’s 1998 play *An Immaculate Misconception*—which employ speculative literary techniques to interrogate the naturalness and immutability of female sex, and to envision a radical future vis-à-vis gender, reproduction, and technology. What emerges is a distinct dialogue about a science- and technology-assisted dismantling and unmaking of the fundamental constituents and functions of biological sex. In their own way, they each feature a radical undoing and refashioning of biology, helping

their readers dream of a world in which women's biological reproductive function is not a given, presenting an alternative tech-utopian feminism that runs counter to much of the modern Western feminist tradition—finding a path to liberation via biologicistic thinking. In this story about the cultural aftereffects of oral contraceptive technology, we see an instance of a larger story about the interaction between technology, speculation, and freedom. Technology and imagination can work iteratively, in tandem, in pursuit of social progress. In this case, the introduction of a new technology is the very thing which opens up an imaginary space for fantasies about future liberatory technologies.

Thematic Approaches to the Study of Science | North America | 20th century, late | Feminist political thought, reproductive biology, speculative future-making

A Web of One's Own: Female Entomologists' Scientific Networks in Late 19th Century and Early 20th Century Britain

L. Joanne Green
University of Cambridge

While historians have shown the importance of networks in nineteenth and early twentieth century European science, women's

networks have hardly been examined. This paper aims to promote a fuller understanding of scientific communities by analysing the intricate connections between gender, class, and imperialism through a reconstruction of four British female entomologists' networks. Margaret Elizabeth Fountaine (1862-1940), Emily Mary Bowdler Sharpe (186?-192?), Mary de la Beche Nicholl (1839-1922), and Eleanor Anne Ormerod (1828-1901) all developed their own networks for different purposes. Fountaine and Nicholl used colonial connections to travel and collect lepidoptera in exotic places. Ormerod used her network to obtain information on insects which were harmful to agriculture and to found the new scientific discipline of economic entomology in Britain. Sharpe meanwhile, became a well-known cataloguer and describer of new species, and constructed a network in which she mediated between buyers, sellers, and the British Museum. In this paper I will look at the strategies women employed to develop their networks, the purposes to which they used these networks, how they engaged in the entomological community, and their position within its hierarchy.

By examining their networks I will argue that empire, gender, and class played an important role in the hierarchies of scientific communities in Britain at the time, much more than professionalisation.

Biology | Global or Multilocational | 19th century
| Networks, Gender, empire, class, entomology,
amateurs and professionals

Access to and Uses of a Natural Philosophy University Collection in the 19th Century

Laura Volkmer

University of Edinburgh & National
Museums Scotland

The Natural Philosophy Department of the University of Edinburgh in the 19th century is mostly associated with their famous professors, known for their inventions or their method of teaching, in which they used a wide range of instruments. In this talk, I will explore who in addition of the teaching staff had access to the instruments of the Natural Philosophy Class during the 19th and early 20th centuries and what these instruments were used for. During the surveyed time period the professors J.D. Forbes, P.G. Tait, and J.G. MacGregor consecutively held the Chair of Natural Philosophy and guarded the department's collection. It appears that during Forbes tenure the objects were

mainly used for demonstration in lectures, whereas under Tait a new emphasis was put on practical work undertaken by the students themselves, and that under MacGregor collection items were regularly loaned to researchers of other institutions. These three uses, demonstration, practice and research, will be illustrated by following the path of a selection of historic objects. About 350 of those objects in part of the Natural Philosophy Collection of the University of Edinburgh survive and are now held at National Museums Scotland. Alongside the instruments came a treasure trove of documents that provide an insight on who could access and use the instruments belonging to the Class of Natural Philosophy.

Thematic Approaches to the Study of Science
| scientific objects, school teaching culture,
material culture, university collection

Air as Resource: Thinking about Air-Powered Transport in the Nineteenth Century

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University of Siegen

In the nineteenth century, air started to be considered not just as an element, but as a techno-scientific resource. The laws of

thermodynamics provided an instrument to exploit air power (specifically, pressured air), and scientists and engineers thought about using it, among others, for the transport of mail, goods, and persons. The product of such techno-scientific plans (some of which were realized, while others remained utopian) were pneumatic tubes, which have been and partly still are an important element in communication and transport infrastructure. The aim of my paper is to analyze the meaning attributed to air power and its infrastructure (pneumatic tubes) in the nineteenth and early twentieth century, while at the same time focusing on the production of scientific and technical knowledge on air-powered transport and its socio-political entanglements. For instance, between 1865 and 1871 the Siemens brothers corresponded with each other about the possibilities of pneumatic mail tubes and how to foster their installation: they called the new science “Pneumatik” and their correspondence is an example of knowledge circulation and techno-scientific transfer between Berlin and London. Visually, air was represented as a goddess (as was electricity), and for the new

infrastructure of pneumatic mail tubes an allegedly ancient Greek tradition was invented. I would like to explore these aspects from the perspective of a cultural history of science and technology, on the basis of published and unpublished.

Technology | Europe | 19th century |
Pneumatics, Cultural history of technology,
Technology transfer

al-‘Āmirī on Nature and the Arts

Nicholas Aubin

Humboldt-University Berlin

This paper explores the view of Nature expounded by the tenth-century Muslim philosopher Abū al-Ḥasan al-‘Āmirī (d. 992). al-‘Āmirī’s understanding of Nature—concerning both its identity and its activity—is a hybridization of Aristotelian natural philosophy and Neoplatonic metaphysics. This background understanding informs his modal account of the beings and events which occur in the natural, i.e. sublunar world. al-‘Āmirī’s natural world is characterized by ‘natural possibility,’ an imperfect regularity which falls short of the perfection and necessity of the heavens. al-‘Āmirī presents a complicated network of relationships between the arts and Nature, and between (individual)

nature and the soul. al-‘Āmirī speaks of the arts as assisting Nature in its activity, as in the cases of agriculture and medicine. He also speaks of the influence of Nature on the arts, by engendering ‘natural’ dispositions in the artist. Elsewhere al-‘Āmirī develops a view of soul and nature in the individual, according to which the soul of an especially spiritual individual will overpower the base nature within him, thus alleviating him of medical care altogether. I examine how his philosophical reflection on this point is connected to the Greco-Arabic medical tradition, its sources and practices. In particular, I consider the context of his view of ‘psycho-therapeusis’ by comparing it to popular Arabic medical accounts from the period, and contrast it with a medical work by Abū Sahl al-Masīhī (d. after 1025) which emphasizes the dependence of psychological states on the body.

Medicine and Health | Near and Middle East | Medieval | Arabic Philosophy, Aristotelianism, Neoplatonism, Nature, soul, the arts

Albums of Emotion: Astronomical Images

Omar Nasim

University of Regensburg

Upon seeing Lord Rosse’s rendition of a nebula in 1845, John F. W. Herschel declared to a large audience that “he could not explain to the section the strong feelings and emotion with which he saw this old and familiar acquaintance in the very new dress.” Previously, when at his own telescope, Herschel had acquired strong feelings and become friendly with the celestial object M51, one that his own Father had formerly observed and drawn. Behind these palpable emotions and legacies were layers of labor that sometimes, as Herschel also reported, caused tremendous amounts of “despair” and “frustration.” Indeed, the visualization of objects and the means of acquiring them (e.g. telescopes) came with memories and experiences, uplifting and discouraging. In each case, what was visualized contained complex emotions, much like a family album. This presentation will contextualize these emotionally packed astronomical images—usually found in catalogues of scientific objects of the nineteenth century—into a

broader history of collecting in the nineteenth-century, including family albums and memorabilia. By doing so, we come to see that scientific images were—besides much else—emotional badges of work and legacy.

Thematic Approaches to the Study of Science | Europe | 19th century | Images, emotions, research objects, astronomy, observation, family albums, work, legacy

Alfred Wallace's Baby Orangutan: A Game, a Pet, a Specimen

Shira Shmueli
Tel Aviv University

British naturalist Alfred Russell Wallace was a freelance collector. During his expedition to the Malay Archipelago he had collected 125,000 specimens, mostly insects and birds, thousands of them previously unfamiliar to European naturalists. Wallace dried, labeled, preserved and packed the specimens and periodically shipped them to his London agent for sale. In the morning of 16 May 1855 Wallace picked up a young orangutan from a swamp in the island of Borneo, Southeast Asia. He carried the little creature home, and for a while lived with the orangutan in his “bachelor establishment.” The relations Wallace had cultivated with the

young orangutan are peculiar in the context of hunting tradition. Read on the backdrop of imperial hunting, the encounter between the naturalist and the orangutan is an anomalous, a momentary breach of the hunters’ agenda. However, when re-contextualized in the history of animal experimentation, Wallace’s treatment of the orangutan joined other incidences in which scientists observed their pet animals, occasionally even subjected them to experiments. Drawing from historian of science Donna Haraway’s *Primate Visions: Gender, Race, and Nature in the World of Modern Science* (1990), I’ll argue that the encounter between Wallace and the baby orangutan is of special analytical value as it is situated at the juncture of hunting narratives, per ownership, colonial bioprospecting and laboratory culture. The entrance of the baby orangutan into Wallace’s home provides an early example for the future complex attitudes towards primates in research, intertwining ideas about family life, care, use and abuse.

Biology | Global or Multilocational | 19th century | natural history, bioprospecting, Alfred Russell Wallace, experimentation, pet keeping

All the Gold in the World: Colonial Extraction, Geology, and Mining Statistics, c.1830-1890

Sebastian Felten
University of Vienna

Large-scale exploitation of new gold ore reservoirs in Russia, California, and Australia from the 1830s onwards shifted the relative prices of silver and gold, disturbed monetary systems around world, and fanned interest both in retrospective statistics and prospective geology. This paper uses German philologist Adolph Soetbeer's publication *Precious Metal Production and the Value Relation of Gold and Silver from the Discovery of America to the Present* (1879) as an entry point into the entangled history of monetary policy, colonial extraction, disciplined geology, and "world" statistics of metal production. Like the early modern government officials and entrepreneurs that he used as his source for data, Soetbeer manipulated scales for visual impact (in illustrations) and for rhetorical persuasion (in discourse). Contrasts between long processes (metallogenesis, colonialism, state-building) and explosive events (discoveries, inventions, wars) structured the past and the future and

harnessed long-term processes to force policy decisions in the present.

Earth and Environmental Sciences | Europe |
19th century | geology, statistics, resources

Alternative Knowledge, Alternative Agriculture: Science for Life on a Damaged Planet

Bradley Jones
Washington University

In the 20th century, agrarian change was dominated by the industrial ideal, in which both farms and farmers were made Modern—rational, efficient, technologically-sophisticated—spurred by ideologies of productivism and progress. These transformations were buttressed by a constellation of collaboration between research scientists, extension agents, policy makers, and agricultural corporations. As a result, the predominant institutions of knowledge production were “captured,” orienting research problems and technological solutions towards agribusiness and large farm interests (Buttel 2005, Fitzgerald 2003, Kloppenburg 1988). This also led to the "academicization of agriculture" in which abstract scientific knowledge flows top-down from specialists to farmers increasingly dependent on expert authority (Cleveland and

Soleri 2002, 2007). While the 21st century brings with it novel academy/industry relations and new formations of biocapital (Jasanoff 2005, Helmreich 2008), it also sees the emergence of alternative agricultural practices supported by alternative ways of knowing. Situating these recent changes within their historical context, this paper focuses on an alternative mode of agricultural production known as biodynamics and examines its foundation in Goethean science. I argue that this model of working with and knowing nature promises to cultivate a more holistic understanding of ecologies of people and plants, but that such approaches are marginalized by dominant reductionist knowledge regimes. At the intersection of feminist science studies and the anthropology of science and technology, this paper shares stories in service of an emerging “successor science” (Harding 1986) with deep historical roots.

Technology | Global or Multilocational | 21st century | Goethean Science, Agriculture, Biodynamics, Alternative Ways of Knowing

An Unlikely Encounter: Arabic Astrology, Seismology, and Vulcanology at the Dawn of the Enlightenment

Monica Azzolini
University of Bologna

The seventeenth century was an intense period of study of volcanoes and earthquakes. Major European thinkers such as Johannes Kepler, Athanasius Kircher, and René Descartes all had something to say about the causes of volcanic eruptions and earthquakes. While none of their theories proved completely right, the fact that an astronomer, a Jesuit polymath, and a philosopher contributed to the debate is indicative of its significance for seventeenth-century intellectuals. While different physical and causal explanations about the formation of lava and the quaking of the earth were proposed, one is often dismissed by historians of geology, namely astrological-astronomical causation. This paper will examine a series of works written by Italian and French authors around the time of the 1631 eruption of Vesuvius and soon after the 1703 earthquake in central and southern Italy to illustrate how, in this period, the Arabic theory of great conjunctions and the study of

eclipses, were taken into serious consideration by a number of intellectuals as a possible cause of these earthly phenomena. Despite the alleged demise of astrology in the seventeenth century, this paper will argue that astro-meteorology remained a well respected and convincing scientific discipline, and that the Arabic authors who underpinned this discipline remained frequently quoted authorities in this field.

Thematic Approaches to the Study of Science | Europe | 17th century | History of Astrology, History of the Earth Sciences

Anachronizing Astrology: Philosophic Prophecy in the Enlightenment

Steven Vanden Broecke
Ghent University

Beginning in the 1660s, but especially after 1680, critics of astrology began to make historical prophecies of their own. According to this prophecy, one would soon encounter astrological beliefs only in the past, and reason would soon, once for all, reconquer the popular mind from superstition. Pierre Bayle, in his famous *Pensées diverses sur la comète* (1683), was one of the earliest voices that issued such prophecies, but he was hardly the last. Throughout the

Enlightenment, anachronizing became one of the preferred tactics for neutralizing the threat of astrology, and remains so today. In this paper, I would like to discuss the Enlightenment trend of anachronizing astrology from three angles. First, I would like to present it as an instance of ‘philosophic prophecy’ (a neologism recently coined by historian of philosophy Eric Schliesser). Second, I would like to trace connections between the technique of anachronizing astrology on the one hand, and conceptions of the manufacturability of human culture on the other. Third, I would like to trace the connections between this technique and (self-)censorship in print culture.

Thematic Approaches to the Study of Science | Europe | 17th century | History of Astrology

Anatomies of the Mind in Enlightenment Britain

Tamás Demeter
Hungarian Academy of Sciences

Anatomy is a widespread metaphor among eighteenth-century British authors. Besides its proper meaning in medical contexts, ‘anatomy’ is frequently put into phrases such as ‘anatomy of nature’, ‘of the mind’, ‘of human nature’, or ‘of the light’. The common core of these different

uses refers to some methodized study of the realm or phenomenon to which it is attached. In the present paper I try to reconstruct the meanings attached to ‘anatomy’ in moral contexts, i.e. in the context of the study of the mind and human nature. As this anatomical enterprise meant different things to various key actors from Locke to Reid, I will try to offer a typology by showing that various projects can be characterized as predominantly descriptive anatomies aiming at the delineation of the mind’s part (as in e.g. Locke’s case), and as predominantly functional anatomies aiming at the excavation of explanatory principles of the mind’s functioning (as e.g. in Hume’s case). I will explore the features of various attempts, thereby 1) locating them on the methodological map of eighteenth-century natural and moral inquiry with a sensitivity to how they are related to dominant methodological influences springing from Baconian and Newtonian legacies; 2) reconstructing how conceptual connections, or the lack thereof, between anatomies of the mind and anatomy proper is reflected in various stances taken on the mind-body problem in this context; 3) and exploring how anatomies of mind

reflect attitudes towards religious values ranging from providential naturalism to methodological atheism.

Medicine and Health | Europe | 18th century | Anatomy, History of Medicine, History of Neurology, Francis Bacon, Isaac Newton

Animal Fables

Cathy Gere

University of California, San Diego

Aesop’s fables, a corpus of animal tales from ancient Greece, take the form of morality tales in which non-humans embody all-too-human weaknesses such as vanity, sloth, credulity and selfishness. One of the translators of the fables, the Anglo-Dutch physician Bernard Mandeville, would later write an Aesopian morality tale of his own: *The Fable of the Bees*. The work – a long satirical poem about the hypocrisy of commercial society – shot him to literary fame when it was denounced as immoral by the Middlesex Grand Jury in 1723. Arguing that Mandeville’s work anticipates many of the themes of evolutionary psychology, this paper suggests that he was the founder of a literary genre that came into its own in the work of Charles Darwin and his followers. It goes on to examine some of the animal fables of science

– from ants taking slaves, to rats pressing pleasure levers, to chimps looking in the mirror – using Mandeville’s literary achievement to ask why and how the stories of non-human natures come so indelibly to stand in for aspects of the human condition.

Thematic Approaches to the Study of Science | Europe | 18th century | Animals, fables, Mandeville, psychology, literature

Animals as Evolutionary Models of Human Sexuality in the Late 20th Century

Erika Milam
Princeton University

How evolutionary biologists have defined animal courtship has had profound consequences for their understanding of how Charles Darwin’s theory of sexual selection might operate among humans. One of the most remarkable applications of evolutionary logic to human behavior came from Donald Symons’ *Evolution of Sexuality*, published in 1979. If male and female heterosexual reproductive strategies fundamentally differed, then Symons reasoned that every sexual encounter between a man and a woman represented a compromise between their dueling desires and agendas. How best, then, to understand true male behavioral

patterns? In matches unfettered by female reluctance. For Symons the frequency of homosexual encounters was the best yardstick by which to measure normative heterosexual desire. His account reinforced gendered stereotypes already inscribed in sociobiology: males possessed a greater sex drive than females, derived from the evolutionary importance of male sexual pleasure. Critical of this argument, Sarah Blaffer Hrdy pushed back by suggesting the variety of female-female sexual encounters in primates provided robust evidence of sexual drive in all females. This paper explores these debates and subsequent transformations in late-20th-century evolutionary accounts of the match. What began as a means of naturalizing heterosexual courtship norms would eventually transform into a potential defense of gay rights as biologists documented numerous examples of same-sex behavior in animals. As a result, the logic of using any one animal as a model of human courtship gave way to seeing human sexuality as reflected in the

wide diversity of sexualities found in the animal kingdom as a whole.

Biology | North America | 20th century, late | gender & sexuality, evolutionary biology, animals, mating, courtship, gay rights

Anthropology, Peyote-Eaters, and the Shifting Morals of Intoxication (1880-1919)

Adam Johnson
University of Michigan

Anthropologists studying American Indians groups in the 1880s and 1890s occasionally remarked on community sects dedicated to the consumption of peyote (*Lophophora williamsii*) for spiritual purposes. These “peyote cults,” which spread from Mexico into the central US in the late nineteenth century, were first seen negatively, as anthropologists worried the hallucinogenic drug would cause significant cultural disruption, akin to the effects of alcohol. This paper evaluates the developing picture of peyote cults in Native American communities from the perspective of visiting ethnographers, tracing the evolving justification for peyote use that practitioners conveyed to inquiring anthropologists. Over time, some anthropologists came to see peyote use as actually beneficial to stabilizing Native communities they studied, as a replacement for

alcohol. In this paper, I show how the growing discipline of anthropology’s acceptance of the “Peyote Religion” was linked to a broader re-evaluation of spiritual syncretism and its place in the anthropology of religion. Specifically, I argue that ethnographic fieldworkers such as James Mooney recast understandings of indigenous spiritual “purity” by studying the consciousness-altering effects of peyote among their Native hosts. Mooney’s advocacy of peyote-eating culminated in his support for the practice’s formalization in the Native American Church (1919)—ratified, ironically, on the eve of Prohibition—which legally protected peyote use for church members while also ensuring (from the perspective of anthropologists) greater social stability in dry Indian communities.

Social Sciences | North America | 20th century, early | anthropological fieldwork, indigenous knowledge systems, intoxicants

Aristotle's Rivals: Early Categoricalism in Ancient Greek Philosophy

Andrew Hull
Northwestern University

Aristotle's Categories is one of the most influential and heavily

commented on texts to survive from antiquity. It is so influential, and presents such a neat contrast to Plato's Theory of Forms, that he is often taken as virtually inventing categorialism as a tradition single-handedly. Yet this is far too neat a picture as his contemporaries Hermodorus (Simp. Phys. 247,33-248,20), Xenocrates (Fr. 12 Lang), and Speusippus (Simp. Cat. 38,19-24; SE Adv. Math. vii 145-146) are all attested as having posited their own categorial schemes. Late Classical Greek philosophy presents us with an abundance of attempts to "carve nature at its joints," but I will be focusing on Speusippus' categorialism as it is the most attested and is likely the one Aristotle was most concerned with given his comments at Posterior Analytics II 13. 97a6-11 and in Parts of Animals I.2-3. I will examine Speusippus' "categorial holism" in this paper, particularly as he applies it in the surviving fragments of his scientific works *Likes* and *Definitions*. I will examine how divisions of plant species in *Likes* depart from Aristotle's own criteria for definitions in the *Topics* while also addressing some of the potential problems of Speusippus' approach (particularly that objection that it is

too epistemically demanding). Despite some shortcomings, however, I will argue that Speusippus and Early Academics were establishing their own unique taxonomy of the world, revamping Plato's method of division to present a powerful alternative that avoids some of the shortcomings of Aristotle and Theophrastus.

Thematic Approaches to the Study of Science | Europe | Ancient Greek and Roman

Artificial Evolution: Åke Gustafsson and the Development of Mutation Breeding

Anna Tunlid
Lund University, Sweden

In the late 1920s, Åke Gustafsson and Herman Nilsson-Ehle started experiments of induced mutations at the Svalöf Plant Breeding Station in Sweden. Already in the mid-1930s, the first viable mutations appeared, and in 1940 an extended research program was set up. Gustafsson devoted much of his scientific career to mutation research. With funding granted by the Swedish government, he established a large national research group with the aim to investigate theoretical and applied aspects of induced mutations. During the 1960s, he became

increasingly involved in the FAO/IAEA Joint Division. In opposition to many contemporary geneticists and plant breeders, Gustafsson never doubted the value of induced mutations for plant breeding, which according to him dealt with the artificial evolution of crop species by changing and accommodating them to human needs and demands. He was dubbed the “father of mutation breeding”. In this presentation, I will outline Gustafsson’s research on induced mutations by using Sheila Jasanoff’s concept sociotechnical imaginaries. I will argue that Gustafsson’s view on induced mutation was part of a sociotechnical imaginary in Sweden that emphasized the close links between basic research and its practical applications and the value of science for the development of society and the welfare state. This imaginary promoted the advancement of science-driven plant breeding technologies to improve crops, increase productivity and achieve national food security. During the 1960s, the sociotechnical imaginary of plant breeding was extended beyond the national borders to include the developing countries, which further stimulated

Gustafsson’s engagement in the FAO/IAEA activities.

Technology | Europe | 20th century, late | Atomic science, Mutation breeding, Åke Gustafsson, Sociotechnical imaginaries, FAO, IAEA

Artisan Entomologists: Stories from the Porcelain Manufactories of Europe

Gabriella Szalay

Renke B. and Pamela M. Thye Fellow in the Busch-Reisinger Museum/ Harvard Art Museums

In the eighteenth century, European porcelain became a critical site for the study of insects. Its pristine, white body made it ideally suited for capturing the incandescent colors of the rapidly growing number of both “local” and “exotic” species. Meanwhile the smooth, rounded forms of most porcelain wares (i.e. cups, saucers, tea- and coffeepots) allowed for the easy illustration of the different stages in the lifecycle of insects. The stories that have been told about these illustrations have been largely ones of reproduction, as scholars have searched for the graphic sources of the images in question. Their efforts reveal that painters at manufactories like the one at Meissen—the first to produce “true” or hard-paste porcelain in Europe—were aware of the work of

earlier interpreters of the insect world, such as Jacob Hoefnagel and Maria Sibylla Merian. They do not, however, account for why entire table services were decorated with insects, as is the case with the “bee pattern” service made at the Meissen manufactory beginning in the 1740s. Nor do they explain why by the middle of the nineteenth century many porcelain painters were listed in the relevant sources as entomologists (Entomologen). As I will argue, the making of porcelain and the study of insects became increasingly intertwined over the course of the eighteenth century, as princely and private cabinets were opened to painters and modelers in the hopes of inspiring them in their designs. By such means the first communities of “artisan entomologists” took flight.

Biology | Global or Multilocational | 18th century
| Art, Entomology, Transfer, Images, Collections

Artisans of the (Prehistoric) Body: Anatomy, Craft, and the American Incognitum

Anita Guerrini
Oregon State University

Between the 1730s and the 1760s, a number of large bones were found in the Ohio River valley. They were widely believed to be the remains of

ancient elephants that had been washed to North America by the Deluge; Buffon and Daubenton also concluded that these were elephant bones. In the 1760s, some of these bones came to London, and to the attention of the anatomist William Hunter (1718-1783). Hunter drew on a wide circle of acquaintances, including collectors, naturalists, fellow anatomists, and craftsmen in ivory, and determined that the bones were not from elephants but from another larger elephant-like animal that was now extinct. His conclusions, published in the *Philosophical Transactions* in 1768, were among the first to acknowledge the fact of extinction.

Medicine and Health | North America | 18th century
| Anatomy, palaeontology, comparative anatomy, collection of bones and skeletons,
Republic of Letters

Assembling Cyclones: The Matter of the Weather in Colonial Mauritius

Martin Mahony
University of East Anglia

Positioned on key maritime trading routes, ravaged frequently by cyclones, and visited periodically by devastating droughts, weather and climate were key concerns of colonial Mauritius. Focusing on the period 1850 to 1920, this paper

examines how tropical cyclones were reckoned with by colonial administrators and scientists. It contends that making sense of and predicting the behaviour of such storms was always more than an epistemic problem. It was also a challenge of piecing together a socio-material assemblage of observation, constituted by passing ships, with their log books and weather-watchers, by reliable instruments and trustworthy, healthy and static observers onshore, and by means of circulating the assembled knowledge such that its lesson could be absorbed by both local mariners and distant savants. Drawing on recent work revisiting the place of materiality in histories of scientific knowledge-making, this paper foregrounds the material politics of meteorology in what might otherwise be a rather triumphalist narrative of scientific progress. It examines first the role of data visualisation and printing practices in both aiding and retarding the development of cyclonic theory. Secondly, the paper shows how, as new theories of cyclone behaviour offered the possibility of anticipation, the tropical climate itself began to intervene in the apparatus of prediction, felling and

jamming telegraph lines, and rendering sites of weather observation uninhabitable. The paper argues for the inseparability of the material and the epistemic in Mauritian meteorology, and questions what that means for our handling of the 'local' in history of science.

Earth and Environmental Sciences | Africa | 19th century | Cyclones, log books, data visualisation, printing, observations

Astrology and Comets: Earthly Symbols and Celestial Signs

Stefan Zieme

Humboldt-University Berlin

In the beginning of the sixteenth century, the interpretation of comets acquired a peculiar dichotomous notion. As phenomena that originated in earthly realms, according to Aristotelian belief, comets were increasingly interpreted according to their accompanying celestial configurations. The apparition of a comet in 1506 heralded the emergence of a novel genre of astrological prognostications related to cometary interpretation. The set of subsequent astrological cometary pamphlets, the first printed in movable type, enjoyed high popularity and wide circulation. Prognosticators followed

an Islamic tradition and enhanced cometary interpretation with astrological reasoning. How could their astrological interpretation relate events across the earthly and celestial sphere? The subsequent, different cometary apparitions of the ongoing sixteenth century entailed a growing effort among astrological prognosticators to overcome this apparent gap between distant Aristotelian spheres by an intricate causal structure. This talk explores the ontological amendment of cometary interpretations in the sixteenth century based on Islamic tradition, and analyzes the prognosticator's endeavor to establish a causal structure that allowed comets to be absorbed into the broader astrological corpus.

Thematic Approaches to the Study of Science | Europe | Renaissance | History of Renaissance Astrology

At Home in the Museum: the Collection of Frederik Ruysch

Isabel Van Paasschen
Yale University

The Dutch anatomist Dr. Frederik Ruysch is best known for his artfully embalmed anatomical specimens. Between roughly 1689 and 1731, Ruysch displayed this collection inside his family home in

Amsterdam. Ruysch's house museum attracted international attention, and became an important space for the creation and dissemination of scientific and anatomical knowledge. To date, a significant body of scholarship exists on Ruysch's life and work: Ruysch's specimens have been analyzed from medical, artistic, and even commercial perspectives. However, the objects in his collection have often assumed center stage; Ruysch's house-museum as a space has received little attention. This paper seeks to place Ruysch's objects in context: it excavates the space they occupied, as it was socially and physically constructed. To do so it draws on two previously understudied sources. First, it conducts a detailed analysis of the visitors recorded in Ruysch's guest books. This source reveals an intimate social environment which revolved around personal relationships. Secondly, Ruysch's estate inventory allows for the detailed reconstruction of each room in the house. A virtual tour of Ruysch's home reveals that the collection was deeply embedded in family life; learning spaces and living spaces were indistinguishable. Thus, while museums are thought to

have become increasingly public in the 18th century, Ruysch's house offers a compelling example of a museum that was in fact private, and highly domestic. By recovering the domestic context of Ruysch's collection, this paper further emphasizes the household as a crucial site for the transmission and creation of knowledge.

Medicine and Health | Europe | 18th century

Beautiful or Dull? Studying Chromosomes under the Microscope

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University of California Los Angeles

To study chromosomes under the microscope they need to be spread and flattened, fixed and stained. In short, they are highly manipulated dead objects in an artificial milieu. Yet in practitioners' eyes, chromosomes have become "hypnotically beautiful objects" (Hsu 1979) to which researchers have remained deeply committed. What makes their observation so fascinating and how has this fascination shaped the development of the field? Drawing on the descriptions of chromosome researchers from the mid-1950s to the early 21st century, the paper will distinguish two kinds of emotional

responses to microscopic observation: on the one hand, the emotional attachment to intimately known objects observed over a long period of time and, on the other, the excitement over new observations, combined with the effort of documenting the extraordinary evidence and the possibility of its loss. More generally, the paper will consider how the reliance on visual evidence represented the strength but also the weakness of chromosome research, especially in the eyes of molecular biologists who spurned images in favor of mathematical analysis and causal explanations.

Thematic Approaches to the Study of Science | North America | 20th century, late | Images, emotions, research objects, observation, chromosomes, microscopy

Behavior (Un)Archived: Research Films in East German Bioacoustics

Sophia Gräfe

Philipps-Universität Marburg

This case study examines the intersections of research film and historical concepts of behavior. Based on the example of early East German bioacoustics it combines approaches from media philosophy and the history of science to discuss the relevance of film documents for

an historical reconstruction of research practices, epistemic structures and political programs. When East German biologist Guenter Tembrock (1918–2011) entered the field of behavioral studies in 1948, research on the biological conditions of human behavior was a contested field. In the East as well as in the West, political visions for post-war societies centered around social vs. biological concepts of human behavior. Based on the observation of domesticated foxes in his modest lab in East-Berlin between 1948 and 1968, Tembrock developed a new approach to behavioral studies. In contrast to his predecessors he didn't merely observe individual animals. Rather he was interested in communication through movement and, particularly, sounds. This formed the core of an ecology of reciprocal resonances. Surprisingly his research methods didn't only include tape recordings. From 1951 on 16 mm-film recordings played a central role in his studies of bio-acoustic behavior. But other than the sound recordings, only little was done to preserve them until today. This paper seeks to present the archival situation of GDR-research films today. Furthermore it will

discuss the historiographic relevance of research films for a reconstruction of the epistemology as well as the aisthesis of historical research settings.

Tools for Historians of Science | Europe | 20th century, late | ethology, Cold War, research film, archive studies

Benchmarking the Self: François-Marc-Louis Naville and His Moral Tables

Harro Maas
University of Lausanne

This paper examines the self-measurement and self-tracking practices of one individual, François-Marc-Antoine Naville, a turn of the eighteenth century Genevan pastor and pedagogical innovator, who extensively used self-measuring instruments to choose a destiny in life and improve his moral character. I situate his practices within emerging regimes of time measurement, ranging from Benjamin Franklin's tools of moral calculation via Marc-Antoine Jullien's moral thermometer, to Benthamite systems of moral control. I provide a detailed examination of how Naville used and adapted these tools to his own, strongly religious purposes. My contribution thus sheds lights on how technologies of quantification

molded notions of autonomy, personal responsibility and citizenship within an emerging utilitarian context that aimed to regulate, control, and optimize human behavior.

Thematic Approaches to the Study of Science | Europe | 19th century | self-measurement, moral thermometer, moral algebra, moral improvement, utilitarianism, deontology, Benjamin Franklin, Marc-Antoine Jullien, François-Marc-Louis Naville

Between "Ethics and Embryos": Reading Assisted Reproductive Technology as Material Fiction

Angela Yu
University of Oxford

From its inception, assisted reproductive technology (ART) – ranging from artificial insemination and in vitro fertilisation to surrogacy and egg freezing – invoked public questions of the world to come. This constellation of emerging technologies was simultaneously credited with the disruption of the sanctity of heterosexual marriage, technological control of women's bodies, the promotion of eugenic fantasies, and the impending creation of a separatist feminist society. Following the first successful birth by in vitro fertilisation in 1978, a growing scientific and medical community

coalesced around the field of ART, and joined the public in these practices of speculation and debate through their professional work and popular communication.

Researchers and practitioners readily engaged questions of how and by whom these technologies would be used – and for what purposes – amid their contested efficacy and ethical status. Through their published research, public advocacy and popular memoirs, infertility treatment pioneers, including Sir Robert Edwards, and Drs. Howard and Georgeanna Jones, actively shaped the material and discursive contours of assisted reproduction. This paper explores how research in ART emerged with and through scientific speculation about the future of society in the United States and United Kingdom during the late 20th century. It further argues that ART occupied the position of a 'material fiction' whereby narratives of anticipated and unsettling futures became essential to address the practical limitations of reproductive technologies themselves. ART researchers and practitioners spoke to the popular fictions of their time, providing insight into the

intersection between biomedical research and rhetoric.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | Assisted reproductive technology, reproduction, science communication, futures, rhetoric

Between Harmony and E-Harmony: Sexual Minima and Utopian Matching in Fourier's "Calculus of Passions"

Hansun Hsiung

Max Planck Institute for the History of Science / Durham University

In his manuscript of 1818 entitled "System of radical sympathies and antipathies," Charles Fourier claimed to have devised "the art...of finding all those persons with whom one is in complete sympathy, and of surrounding oneself with them instantly and constantly." Unfolding across 117 pages the "algebraic formulas" that would allow for this "matching [assortment] of characters," Fourier argued that a "calculus of passions" was key to the management of relations in his phalanstères -- communities dubbed simply "Harmony" by Fourier, and envisioned as a socialist solution to the woes of capitalist "civilization." Whereas, in "civilization," persons "often spend years in a city without encountering sympathetic partners in love," in "Harmony," "no one would

be left out or miss out on an appropriate match." This paper unpacks the political stakes, informational processes, and mathematical techniques of Fourier's "calculus of passions," to argue that so-called "utopian" socialism in part pioneered the discourses and practices of "matching" behind contemporary data-driven approaches to finding "matches." As a self-styled Newton of the social world, Fourier championed the need to discover laws of "passionate attraction" analogous to universal gravitation. As an early critic of industrial capitalism, Fourier proposed that "free love" required scientific management, lest it degenerate into an unequal free market of love. Technologies of matching, in this sense, went hand-in-hand with his problematic demand for the right to a "sexual minimum" alongside universal basic income, and his faith that this minimum, through proper practices of information collection and analysis, was an achievable reality.

Mathematics | Europe | 19th century | gender & sexuality, instruments & measurements, political thought, utopianism, social science, 19th century

Between Order and Chaos: Telegraphy and the Stresses of Everyday Life

Jean-Michel Johnston
University of Oxford

The unprecedented speed of telegraphic communication was the source of considerable excitement across Europe during the nineteenth century. The technology, it was often held, heralded a new age of instantaneous interpersonal communication, which would simplify the conduct of business, politics, and even everyday life. Looking back upon the period, we might be tempted to describe the revolutionary impact of the electric telegraph in a similar way, recognising its contribution to the global standardisation of time, to the streamlining of international diplomacy, to the organisation of the global securities market, and even to the elaboration of reliable weather forecasts—the historian James Beniger went so far as to call it a modern ‘control revolution’. The telegraph was a double-edged sword, however, and many contemporaries were in fact concerned that the speed of communication would upset the well-established structures of everyday life, with its ceaseless

interventions into social relations, its interference with the channels of geopolitical communication, and its capacity to throw financial markets into turmoil with a dose of unexpected news. This paper examines the hopes and disappointments experienced by users of the telegraph across Germany, from politicians to businessmen, agriculturalists, and even ordinary villagers, as they turned to the technology to help them manage the vagaries of everyday life.

Technology | Europe | 19th century |
Technology, telegraphy

Between Signal and Symbol: Sound, Speech, and the Data of Language

Xiaochang Li
Stanford University

In 1969, J. R. Pierce, executive director at AT&T Bell Laboratories, called for a suspension of all speech recognition research, condemning the field as an “artful deceit” perpetrated by “untrustworthy engineers.” Automatic speech recognition, he insisted, could not be solved through engineering, and would be possible only once computers incorporated linguistic expertise comparable to a native

speaker. Just two years later, IBM launched its Continuous Speech Recognition research group, which developed a data-centric approach that became standard not only in speech recognition and natural language processing, but across “big data” and machine learning applications for everything from financial modeling to bioinformatics. Frederick Jelinek, the IBM group’s director, infamously attributed their success to firing all the linguists. This talk looks at the history of speech recognition research as it was refashioned from a problem of simulating language to one of sorting data. Starting in the 1970s, speech recognition research shifted from efforts to study and simulate the processes of speech production and linguistic understanding to what researchers characterized as a “purely statistical” approach, organized around the technical and commercial demands of digital computing. I examine how the problem of automatic speech recognition, laden with the technical challenges and institutional legacies of acoustic engineering, helped bring language under the purview of data processing—and how, in the process, speech recognition research

became critical in shaping the conceptual, economic, and technical terrain that gave rise to data-driven analytics and machine learning as privileged and pervasive forms of computational knowledge.

Tools for Historians of Science | North America
| 20th century, late | History of technology,
linguistics, sound, speech, computation

Between the Lab, Field, and Garden: Experimental Psychology and Ethnology ca. 1900

Cameron Brinitzer

History & Sociology of Science, University
of Pennsylvania

In the late-nineteenth and early-twentieth centuries, a methodological controversy emerged around the scientific problem of understanding human color vision in evolutionary terms. While the first experimental psychology laboratories were being constructed across Western Europe and North America to subtend a natural science of mind, zoologists and ethnologists were simultaneously researching color vision among populations outside Europe. In the early-twentieth century, the “colour-sense controversy” crystalized among experimentalists seeking an understanding of human color vision

in ontogenetic and phylogenetic terms. To build a natural science of mind capable of accounting for visual perception and attendant forms of cognition, these experimentalists moved between psychological laboratories, anthropological expeditions and field sites, and experimental apparatus which some built in their own homes and gardens. This paper shows that an overlooked product of the colour-sense controversy was the methodological specification of “looking-time” (a combination of direction and duration of optic fixation) as a scientific measure of perception and cognition. At the turn of the century, these experimentalists argued that measures of looking-time provided access to the nonverbal minds of human infants, while also authorizing research among linguistically-diverse peoples. While looking-time is often thought to have been operationalized during the 1950s, attention to the material stuff of psychological experimentation around the turn of the twentieth century reveals a sustained methodological controversy surrounding the utility of looking-time as an experimental measure in research concerned with color

vision. Finally, attending to the material cultures of human sciences circa 1900 calls into question neat divisions between laboratory and field sciences.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 20th century, early

Biodiversity on Display: Museological and Scientific Practices in Natural History Museums Exhibitions

Mariana Soler

IHC - CEHFCi - University of Évora

Exhibitions are social constructions in which information and archives are selected by professionally diverse teams, whose work may be influenced by institutional and financial contingencies. In natural history museums, expography has drastically changed during the last two centuries. Scientific and museological practices are fundamental factors influencing these changes. The increasing circulation of objects, bibliographies and professionals among European and American museums may also have influenced exhibitions design. Inasmuch as the history of museography in relation to its own circulation in natural history museums is still incipient, this thesis proposes to identify ways of display

that represent museological and scientific practices in Brazilian and Portuguese natural history museums, by analyzing five contemporaneous exhibitions in which "biodiversity" is a central concept. After reviewing the literature on history of science and museology, we constructed a matrix with indicators which allowed us to recognize different expographic patterns, from the nineteenth century until nowadays. We identified overlapping of ways of display, once in the same exhibition there were different types of representations of scientific practices and concepts. Our preliminary results show that even exhibitions designed after 2010 still have specimens displayed according to design patterns typical of the previous centuries. Although we noticed the importance of researchers and their practices in the conception of exhibitions, different patterns in the same space and narrative indicated the existence of other factors affecting the ways of display. Identifying the origin of these factors will allow us to establish a panorama of influences

on science representation in museological institutions.

Biology | Global or Multilocational | 21st century
| exhibitions; circulation; natural history
museums; expography

Birth Machines and the Turn to Physiology in Twentieth Century Obstetrics

Martina Schlünder

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Science, Berlin

Since the eighteenth century, childbirth in Western medicine has been understood as a mechanical procedure consisting of a regular sequence of foetal movements through the mother's womb. At the beginning of the twentieth century, the reasons for these movements were not yet understood. What kind of mechanical and expulsive forces were at work in the birthing process? At the turn of the twentieth century, German obstetrician Hugo Sellheim (1871–1936) embarked upon a research project to answer this question by exploring the laws of birth mechanics. For his experimental studies, he designed new research tools, so-called "birthing machines". In contrast to older obstetrical machines, these "machines" performed the birth process not along anatomical lines but, rather, simulated it from a

strictly functional-mechanical perspective. The paper argues that studying these machines offers an excellent lens to examine the epistemic shifts that obstetrics underwent in the early twentieth century, when it moved from an anatomical to a physiological paradigm, leaving the focus on the pelvis-skull ratio behind, instead studying the impact of mechanical laws on soft tissues and its flexibility. Sellheim aimed at establishing a norm, a standard procedure of delivery based on experimental, scientific knowledge that also captured all of its possible deviations, turning treatments from improvised and experience-based interventions into standards based on scientific norms. I analyze Sellheim's experimental system from a material-semiotics perspective to show how these objects and epistemic shifts more generally were always entangled in practices imbued with gender and class politics.

Medicine and Health | Europe | 20th century, early | instruments, obstetrics, body, birthing machines, Germany

Bloated Bellies and Bleeding Thyroids: Needling at Gendered Bodies in Acupuncture Anesthesia (1950-1970)

Lan Li

Acupuncture analgesia seemed relatively straightforward. The patient lay awake as a practitioner needled selected sites on the body to induce numbness for surgery. Numerous reports emerging from China in the 1970s featured women and men resting on operating tables, smiling into the camera, surrounded by doctors who attended to the excised region—the esophagus, brain, belly, heart, or lungs. Readers were as amazed as they were skeptical. To one critic, acupuncture analgesia worked, but it only worked on Communist Chinese bodies. Beyond the ontological debates that surrounded how needling actually worked, was the curious ways in which the patient and practitioner both participated in a choreography of knowledge production. Needling-induced numbness allowed the patient to lie awake during the operation. She could ask questions, drink tea, eat fruit as nurses reached into her body to remove an ovarian cyst. This paper argues that the choreographed epistemology of the operating room, or “improvised

medicine” as Julie Livingston would put it, re-constituted dualities that defined expertise, indigenous knowledge, and gender. Between the patient and practitioner, *zhongyi* (“Chinese” medicine) and *xiyi* (“Western” medicine), and feminine and masculine bodies were the multiple effects of needling that challenged assumptions about how responses to pain changed over time. Those who tested the effects of needling-induced numbness in Singapore, Hong Kong, Michigan, Berlin, and Shanghai hoped that its universalizing effects could reflect the universal properties of needling—that it could temper the idiosyncratic nature of the body and collapse conceptual differences. By drawing on literature in transnational feminism and postcolonial STS, this paper offers a cultural history of neuroscience through the queering effects of needling in the operating room.

Medicine and Health | Global or Multilocal | 20th century, late | numbness, acupuncture analgesia, transnational feminism, pain

Botany and the Science of History I (ca. 1800-1900)

Fabian Kraemer

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The boundaries between the humanities and the sciences have traditionally been seen as solid and more or less impenetrable; however, in view of the closely entangled developments of the history of (non-human) nature and the history of (human) culture they may not be as unproblematic as first thought. This paper, together with the following (by Nickelsen), traces this debate with a focus on the tradition of writing the history of culture and civilization in the nineteenth century. For the most part of the century, cultural history centered on the texts and objects studied by historians, philologists, and archaeologists. However, botanists were increasingly eager to bring their knowledge of seeds and plants into the discussion and to claim a place for these objects as key sources in the study of cultural history. They thus called into question the historical disciplines’ exclusive authority over human history. Nineteenth- and early twentieth-century debates on

“cultural history” were a hotbed of discussion on the epistemic value of different types of sources and the disciplines that were best equipped to interpret them. The paper examines in particular the attempts made by a group of Berlin-based botanists around Georg Schweinfurth (1836–1925). When this group claimed, in 1906, to have found the progenitor of cultivated wheat (Urweizen) in Palestine, Schweinfurth declared this the most important discovery of his lifetime. I argue that this cannot be understood without recourse to of the period’s burgeoning discourse on the origins of human civilization.

Thematic Approaches to the Study of Science | Europe | 19th century | history of botany, history of cultural history, history of civilization, the two cultures

Botany and the Science of History II (ca. 1800-1900)

Kärin Nickelsen
LMU Munich, History of Science

In close alignment to the preceding paper of the panel (Krämer), this paper explores the entanglement of nineteenth-century natural and cultural histories further. Specifically, it traces how and why nineteenth-century botanists claimed a role for themselves in the writing of cultural history. Most

importantly, botanists pointed to the fact that the history of human culture was intimately connected to the history of “agriculture” and the cultivation of plants. The beginning of culture in the sense of civilization was commonly linked to the transition from hunter-gatherer societies to agriculture. The history of cultivated plants, such as wheat, hence, was at the center of cultural history in this broader sense (which historians of science have so far ignored). This history was then mostly written based on philological methods; but this, botanists claimed, was insufficient. One had to study the actual object sources not only their names. The botanical study of plant geography, including the migration of plants over time and the search for their sites of origin – as in the case of the Urweizen – , was therefore of utmost importance to the history of human culture, so the argument went. The paper shows how, drawing on this tradition, botanists were eventually able to claim that without botanical expertise the study of cultural history was incomplete. Moreover, Schweinfurth even called for a radically altered understanding of “culture” that was no longer exclusively focused on written

scholarship but acknowledged the growing importance of the sciences.

Biology | Europe | 19th century | history of biology, history of botany, history of cultural history, history of civilization, the two cultures, plant geography

Bricolage and the "Modern Order" of the Codex Roccabonella

Sarah Kyle

University of Central Oklahoma

Around 1445 the artist Andrea Amadio translated the plant imagery of a luxury herbal manuscript into a more extensive, stylistically-diverse illustrative cycle. This new manuscript contains the pharmacopoeia of Venetian physician Nicolò Roccabonella (1386–1457), which distils traditional medical texts and compiles lexica of plant names (Bibl. Marciana, Lat. VI, 59 [=2548]). The textual and visual information constitutes his efforts to place the knowledge of plant drugs, as Roccabonella says, into “some more modern order”. In its improvised assemblage of traditions and sources, this “order” can appear disordered. However, the apparent randomness of Roccabonella’s text, while drawing on humanist methods of note-taking and knowledge-building, encourages a new kind of reading practice – one reinforced by

the heterogeneity of Amadio’s illustrations. The herbal acts as a bricoleur, putting established artistic, literary, and medical systems into play with emerging forms of experiential knowledge. In form and content, the book creates a generative space for the construction and testing of new knowledge, what Roccabonella calls a “specific foundation” for the development of new fields of botanical and medical inquiry in the early modern era.

Thematic Approaches to the Study of Science | Europe | Medieval | herbal, pharmacopoeia, plant drugs

Broken World Botany: Slavery and Natural Knowledge in the West African Slave Trading Zones

Carolyn Roberts

History of Science and Medicine, Yale University

Literature on the circulation of natural knowledge in the Atlantic world offers rich discussions regarding the significance of non-European peoples in the development of colonial and metropolitan science and medicine. The Americas has been a foundational geography in this scholarship. Historians have shown the intense epistemological struggles that ensued between Amerindians,

Africans, creoles, and Europeans who lived, labored, and died together. However, one region that was pivotal in Atlantic knowledge networks remains largely absent — West Africa. This paper illustrates how the West African slave trading zones functioned as unique spaces in Atlantic itineraries of science and medicine. Frequently crumbling fortresses like Cape Coast Castle on the Gold Coast were transient, biocontact zones laced with violence, dehumanization, and disease. There were few long-term European residents; professional naturalists made only rare appearances; and bare-life existence often subsumed all else. As such, I argue that gathering natural knowledge was characterized by an eclectic empiricism that had limited institutional support and scarce resources. Using fragmentary evidence culled from travel narratives, correspondence, and merchants accounting records, I argue that slave traders often functioned as scientific scavengers, seeking to consume West African natural knowledge wherever such might exist — whether in the malnourished bodies of enslaved people who had been trafficked hundreds of miles, or among

enslaved boys who grew physic gardens at slave factories. This paper problematizes early modern science and medicine by examining knowledge-making in a profoundly broken West African world.

Biology | Africa | Cultural and cross-cultural contexts, including colonialism in general | Botany, slave trade, Atlantic world, West Africa, medicine, science

Building Nature's Archive: The Management of Paper and Specimens in the Berlin Zoological Museum

Anne Greenwood Mackinney
Humboldt-Universität zu Berlin

In the first years of its existence between 1810 and 1815, the Royal Zoological Museum in Berlin processed just over 60 new animal specimens into its collection. In the few years following, this modest number of incoming specimens had exploded into the thousands, such that the museum's shelves were already running out of room by 1818. New paper technologies needed to be developed to oversee and control the flow of material into, within, and back out of the collection institution. As the museum's growth rate continued to accelerate, it soon became not only a problem of managing specimens, but also one of managing the

“constantly growing mass of paper,” as museum director Martin Hinrich Lichtenstein lamented in 1819. This talk will analyze both the lists, catalogs and inventories designed to trace the movements of specimens as well as the archival infrastructure that Lichtenstein erected to maintain these very paper tools. Moreover, I will contextualize the museum director’s attempts to keep track of both the institution’s objects and its papers within broader shifts in Prussia’s state bureaucracy and archival landscape. By focusing on the transformation of recordkeeping practices in the museum’s early decades, the talk ultimately illuminates how these paper tools and the archive in which they were stored shaped—and still shape—the kinds of knowledge that can be created from collected specimens.

Thematic Approaches to the Study of Science | Europe | 19th century | archives, natural history museums, record-keeping

Can Space Age Cultural History Help Save the Future

Peter Kleeman

UMass Amherst / Space Age Museum /
Smithsonian National Air and Space
Museum

How can we envision our Star Trek future in space? Contributing to the conference theme of “Telling the

Stories of Science,” this paper will discuss the intersection of audience, concepts of failure, and visions of the future as represented in the cultural history of the Space Age. Mythic visions of a future in outer space were central in Space Age imagination and deeply engaged public audiences, particularly through material culture and science fiction. Burgeoning 20th-century technologies allowed people to contemplate humanity’s place in the cosmos in a more imaginative and technological way than ever before. Part of that philosophical-cultural exercise involved pondering the distant future of humanity, one that was often imagined as unfolding beyond the confines of planet Earth. But what happens when public interest in lunar landings dwindles to the point of NASA canceling the Apollo program early? And how do we reconcile the excessive consumerism that delivered Space Age ideals with the environmental consequences of manufacturing and waste? Now, over ninety-years since the dawn of the Space Age, we can look back at the dreams of the era and reflect on how they have both served society, and failed us. Disenchanted by failure to quickly realize utopian dreams off-world,

photos shot looking back from the Moon reveal our fragile “Spaceship Earth” floating in the void. Forced to reflect upon our planetary failures, particularly regarding ecological challenges, what can we learn from past mythic visions of the future to better tell stories of science that empower audiences today?

Theoretical Approaches to the Study of Science
| North America | 20th century, late

Captive Healthscapes: Slavery, Medicine, and Natural Inquiry in Early Modern Italy

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Technology

This paper explores the entanglement of slavery, medicine and natural inquiry in early modern Italy. It focuses on the healing spaces and practices that developed alongside the creation of a Bagno, a purpose built edifice that housed a large community of up to 3,000 (mostly Ottoman) slaves in the Tuscan port city of Livorno. In the early modern period, the presence of slaves in the Italian peninsula was largely related to the struggle between Ottoman and European powers for the control of Mediterranean territories. In recent years, scholars have started to shed

light on the role of slavery in the economic and political strategies of early modern Italian states. However, little is known about the health-related practices and the processes of knowledge-making that were incidental to the presence of enslaved communities in the Italian territories. This paper explores how such practices and processes participated in shaping the early modern world of healing and medical and natural knowledge. On the one hand, it considers how physicians and natural inquirers were involved in maintaining and supporting the institution of slavery and relied on enslaved bodies to construct knowledge, authority, and reputation. On the other hand, it examines how Ottoman captives acted themselves as healers who provided for different constituencies, including the residents of the cities in which they were held in captivity. By interrogating the health and knowledge practices associated with the Bagno in Livorno, this paper will shed new light on the forms of encounter and conflict informing early modern healthscapes.

Medicine and Health | Europe | Cultural and cross-cultural contexts, including colonialism in general | Health, Slavery, Medicine, Natural Inquiry, Italy, Mediterranean

Changing Minds: Feminist Methods in Anthropology

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During the late nineteenth and early twentieth centuries, Anglo-American anthropologists conducted field expeditions to disparate regions. Some of these anthropologists contributed to the social reform efforts of a trans-Atlantic community of Progressive experts. Within this highly populated landscape, a small field of feminist anthropologists emerged with a distinctive set of ethnographic methods. My paper will trace the empirical practices of one such figure: Elsie Clews Parsons. Parsons formed queer kinships with a disparate group of cultural anthropologists who straddled the socialist-pacifist salons of Greenwich Village, the settlement houses of Chicago, the academic departments of Columbia and U.C. Berkeley, and the artist colonies of Sante Fe. With ample personal connections and financial means, Parsons conducted fieldwork with the Pueblos of New Mexico and Arizona. In 1918, after revitalizing the cultural anthropology program of Franz Boas, she began to experiment with ethnographic writing. She

learned how to bring the changing minds of indigenous subjects into the cultural foreground, thereby capturing the development of human personalities. This interpretive skill, I argue, emerged from her encounters with several "men-women" and Zuni women conducting domestic labor. Parsons, while writing about these experiences, denaturalized gendered norms circulating within Pueblo culture. She then turned these observations back onto her own culture, leading her to generalizations about the dynamics of power and mind. This conceptual practice -- what Sarah Richardson might term a "gender-critical" method -- sustained her identity as a feminist anthropologist. My exploration of Parsons places feminist science studies into historical relief.

Social Sciences | North America | 20th century, early | gender, history of human science, feminist science studies

Charting an Environmental Frontier: The Hydrographic Expeditions of Colonial Spanish America to the Western Patagonian Channels (1760s-1790s)

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As the European empires expanded to the Pacific region in the 18th century, the passages that linked the Atlantic with the Pacific Ocean began to play a more significant role in the connection and navigation of the globe. In spite of it being perceived as a remote and a dangerous environment, the southern passages such as the Patagonian channels attracted the attention of several scientific expeditions conducted by the British and Spanish Empires. Recently, historiography has addressed the Spanish metropolitan expeditions that transformed this remote waterscape into a scientific laboratory by fathoming and charting this seascape. Building on this, the paper will focus on the scientific expeditions sent by the colonial authorities in Spanish America, emphasising their role and contribution to the knowledge of the region. The paper will explore two ideas. Firstly, it will address this

seascape as an environmental frontier, exploring the geographical images generated by these local expeditions that depicted Western Patagonia as a dangerous and untamed nature. Secondly, it will address the way in which the expeditions sent from Lima and Santiago generated a corpus of local knowledge, highlighting the role of Spanish pilots based in South America and the expertise of local sailors in the production of hydrographic and geographic knowledge of the Patagonian environment. By studying such cases, this paper challenges the more traditional perspectives that depict the region as a mere consumer of metropolitan knowledge, as it explores the ways in which the Patagonian environment influenced the scientific practices of the explorers.

Earth and Environmental Sciences | Latin America | 18th century | Patagonia, colonial, exploration, scientific practice, maritime, environment, geography, local knowledge

Chemical Bonding: Ritual and Community-Formation at Chemistry Conferences, 1921-22

Geert Somsen
Maastricht University

In 1921 and 1922 the Utrecht-based chemist Ernst Cohen organized two

informal international conferences. Their aim was to break the boycott of scientists from the former Central Powers that was the official policy of the new international scientific organizations established in the wake of the First World War. Like many scientists from formerly neutral countries, Cohen rejected that policy and tried to reunite his German and Austrian colleagues with their French, Belgian, British, Russian, and American counterparts. The two Utrecht meetings were meant as an “experiment” at such reintegration. In this paper I examine not so much the success of this attempt, but primarily how it was done. By what means did Cohen et al. try to re-establish a broken community? Precisely because this was the only objective of the two meetings, and their subject-matter was relatively unimportant, they offer a window on the mechanisms of community-formation at conferences. What was articulated, for example, at the speeches and toasts? What was the function of the excursions and banquets with courses named after famous chemists? What was the role of spouses in the meetings? And what was the meaning of the various papers, on subjects like “free

radicals” and “bonding through light”, for the social aims of the conferences? These rituals have to be situated not only against the background of the war and its rifts, but also in the light of an elite culture of academic scientists faced with their increasingly important, and problematic, industrial connections.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, early | Chemistry, boycott, World War I, conference culture

Children as Scientists: Ontogeny and the Social Construction of Cognition

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George Washington University

This paper examines how psychologists treating children as though they are little scientists helps explain the fate of recapitulationism in the human sciences. Thinkers in the 19th and 20th centuries from Charles Darwin, Herbert Spencer, and Ernst Haeckel to G. Stanley Hall, John Dewey, and Jean Piaget advanced the idea that cognitive development in individuals repeats the long-term development of civilizations. However, after World War II Americans who treated children as scientists largely eschewed linear evolutionary

models of mind. This paper explains how this transformation of psychology depended on two sources. The first was an extension of pre-existing efforts within the new field of cognitive psychology to understand adult humans as scientists. The second was what might now seem an inversion of intellectual hierarchies: scientists learned from humanists about children and about how thinking works. Psychologists found in case studies written by post-positivist historians and philosophers models of conceptual change that seemed to explain what happens to children as they age. These lessons also meant that psychologists would abandon the view that both the history of science and childhood involves a single pattern of linear progress. Indeed, rather than asserting that the ontogenesis of individual cognitive development parallels the phylogenesis of science, developmental psychologists came to argue that children are better at science than adults. Following historians also led psychologists to assert that not only their own discipline, but their very object of

study, the child, was a social, historical construction.

Theoretical Approaches to the Study of Science
| Global or Multilocational | 20th century, late

Citizen, Science, and Citizen Science

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The term “citizen science” has become very popular among scholars as well as the general public. The rapid expansion of citizen science, as a notion and a practice, has spawned a plethora of meanings. One of the most common usages today refers to voluntary lay participation in the production of scientific knowledge, often in the form of “crowd sourcing” on an Internet platform such as Zooniverse. So here lies the issue: the notion of citizen science is both very diffuse and very specific. To address that issue, this paper tries to do two things. First, it argues that it is necessary to situate what is called “citizen science” in the relevant historical currents/contexts. “Citizen science” draws on and derives from various historical traditions of knowledge production. It has not come from nowhere. With a historical perspective, we will be

able to see the genealogy of citizen science and the limits of a presentist, ahistorical definition of citizen science. And, second, this paper suggests that a fruitful – and politically relevant – way to understand citizen science is through the concept of citizenship. The existing literature has focused more on the “science” rather than the “citizen” part of citizen science (while admitting that they are mutually constituted). It tends to take for granted the political/communal framework in which such scientific activities are designed and conducted. This paper proposes a new perspective that will allow us to better interpret various modes of citizen science in different times and societies.

Aspects of Scientific Practice/Organization | Global or Multilocal | Cultural and cross-cultural contexts, including colonialism in general

Clandestine Revival of Prague Linguistic Circle in Prague, 1945-1968

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In the decade preceding World War II, the so-called Prague Linguistic Circle (Prague linguistic school) developed the ideas of Ferdinand de Saussure. While the original circle

practically ceased to exist during World War II, its ideas were clandestinely revived and developed during the rule of the Communist Party of Czechoslovakia (1948-1989). Just after WWII, digital computers were entering the scene, promising to provide researchers of all branches with a powerful tool. Linguists, like other researchers, were not entirely united as to their hopes in the new technology. In the Soviet bloc, the visions of using the computer were also influenced by the ideological pertinence of such use. While the use of computers by mathematicians, astronomers, physicists, and engineers was undisputed, using computers to aid linguists was not supported in the early 1950s. Expelled from the Faculty of Arts for their wishes to do linguistics on computers, the Circle found refuge at the Faculty of Mathematics and Physics. While initially the linguists took their new location only as a substitute to the desired one, they gradually won their position among linguists abroad and after 1989, revived the original name. The presentation will focus on the effects of this forced institutional position of linguists close to the departments of mathematics and computer science

and will analyse the development of computer-based linguistics in this context.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | Prague linguistic circle, machine translation

Classification and Gentlemanly Capital: Thomas Pennant and British Zoology, 1766-1812

Edwin Rose

University of Cambridge

One of the most successful natural history publications of late eighteenth-century Britain was *British Zoology*, authored by the Welsh naturalist, Thomas Pennant (1726–98). This book, that met four major editions between 1766 and 1812, was produced in a range of different formats and contains numerous copper-plate images based on specimens from Pennant’s natural history collection. Pennant used two main systems of classification in *British Zoology*. The first, which he used for quadrupeds and birds, was that devised by John Ray in the late seventeenth century. The second, which he used for aquatic organisms, such as fish and shells, was the system developed by Linnaeus from the 1730s. Pennant’s decision to use these alternate classificatory systems was influenced by his different

approaches to observing terrestrial and marine animals in the field. Whereas he tended to classify aquatic creatures according to their physical characteristics, in the case of birds and quadrupeds he took into account the sounds they made, their social attributes, and preferred environment. This classificatory divide shaped the physical makeup of the book, which Pennant distributed to ‘every country gentlemen’, utilizing commercial publishing markets. However, Pennant was careful to adhere to gentlemanly etiquette, ensuring that he never directly profited from his publications, showing how natural history collecting and debates regarding classificatory practices were intertwined with the late eighteenth-century commercial publishing industry.

Aspects of Scientific Practice/Organization | Global or Multilocational | 18th century

Classifying Animals: Aristotelian Zoology in Thirteenth-Century Latin Scholasticism

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How are animals to be classified? What gives unity to an animal species? What are the criteria for animals to be part of the same

species? Variants of such problems are as intriguing to contemporary philosophers as they were to Scholastic scholars after Michael Scot translated three of Aristotle's works on animals (History of Animals, Parts of Animals and Generation of Animals) from Arabic into Latin at the beginning of the thirteenth century. The first extant commentary (1240s) on this compilation, entitled *De animalibus*, was written by Peter of Spain, a physician, who most likely also commented on the *Articella*, a standard medical textbook at the time. Somewhat later, Albert the Great (1200-1280) wrote a second and much more influential commentary on the same compilation with more than 40 manuscripts still extant. In my presentation, I intend to explore the fabric of questions about animal species and classification as it was proposed in the commentaries of Peter and Albert, and I will show that these classifications extended well beyond an easy appeal to common natures or essences. I also intend to show how these classifications of animals were inseparably linked to the way in which the science of animals was construed, and how it was supposed

to relate to natural philosophy and to medicine.

Thematic Approaches to the Study of Science | Europe | Medieval

Climate Science By and For Citizens

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It is widely recognized that achieving sustainability in the twenty-first century will require a reorientation of scientific research towards “usable” knowledge, particularly when it comes to climate change. The Intergovernmental Panel on Climate Change, for instance, was created to translate science into policy, but it has focused on long-term predictions of global temperature, rather than on shorter-term, regional-scale predictions that could help guide local policies. Generating actionable climate science will require incorporating the knowledge, experience, and values of those impacted by climate change into the process of producing and evaluating new research. This reorientation is already in progress—evident, for instance, in recent initiatives to incorporate the knowledge, experience, and values of “users,” “stakeholders,” and indigenous

communities into the process of producing knowledge about the impacts of anthropogenic climate change. Strong claims are being made for the novelty of these modes of generating climate knowledge, but with little attention to history. In fact, the precedents for involving non-experts in scientific research date back to the very birth of professional science in the eighteenth century. This presentation considers the history of “co-production” in the earth sciences in order to identify the contingent assumptions and limitations of our own ways of doing science. I conclude that usability needs to be defined more broadly. In fact, conceptions of “useful knowledge” drawn from the past can help point the way forward.

Aspects of Scientific Practice/Organization |
Global or Multilocational | Cultural and cross-
cultural contexts, including colonialism in
general

Clues in Recipes and Verses: Transmission of Malay- Language Books of Medicine and Cross-Cultural Mediation of Natural Knowledge in the Dutch East Indies

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Malay-language recipes compiled in modern manuscripts, now catalogued as kitab tibt, kitab obat-obatan, and kitab mujarrabat, have become an essential part of Malay manuscript collections particularly in the Indonesian archipelago and in western Europe. These latent compilations of humoral, Prophetic, and indigenous medicine not only include recipes using plants from the eastern archipelago but also detailed instructions for creating amulets to be used for war as much as for love. This paper explores different possibilities for understanding how recipes pertaining to women, children, and to the household were historically transmitted and eventually compiled or copied by male scribes in local court or Islamic settings in island Southeast Asia. I argue that one way of contextualizing the historical formation of these manuscripts is by tracing their fragments in early modern Malay, Arabic, and Dutch

texts about medicine, religion, and natural history, and to do so with an eye toward the workings of gender and class in processes of mediation and in mediated information. In bridging the gap between histories of manuscript transmission and of cross-cultural interaction in the Dutch East Indies, this paper attempts to recalibrate the cultural scales of secrecy and exclusivity as applied to medicinal and religious knowledge in the archipelago.

Thematic Approaches to the Study of Science | Southeast Asia | Cultural and cross-cultural contexts, including colonialism in general

Cochineal Husbandry in Eighteenth-Century Mexico and India

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During the eighteenth-century, the Spanish Empire held a virtual monopoly on the production of cochineal, a lucrative red dye commodity sourced from insects grown on cacti largely in the south of modern day Mexico. The cochineal insect had been domesticated and grown by the indigenous peoples of central America for centuries before the arrival of the Spanish. It was widely known as ‘nocheztli’ or ‘blood of the nopal cactus’. Cochineal was

situated in a cultural matrix which influenced the insects’ complex husbandry and development as a domesticated species in southern Mexico. In the late eighteenth-century the British East India Company attempted to turn southern India and Bengal into production zones for cochineal (Fray, 2012). In making India a major producer of cochineal the Company hoped to turn a substantial profit and break the Spanish monopoly. British promoters of this scheme assumed similarities between India and Mexico in areas of landscape, peoples, cultures, plants and insects. Critically British colonial promoters believed the landscapes and indigenous peoples of southern Mexico would be interchangeable with the landscapes and peoples of southern India and Bengal. These assumptions led to the failure of the project. Even in Guatemala, geographically next to Mexico, the cochineal industry had been impossible to transport until native Oaxacan cochineal growers had accompanied their insects and taught methods of husbandry. The movement of the cochineal industry to Guatemala in a similar time

period offers a contrast to the failed British project in India.

Social Sciences | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general | Cochineal insects, history of entomology, indigenous technologies, climate

Cold Spring Harbor Laboratory–Sarajevo–Moscow: An Unlikely Network in the Fight against Lysenkoism in Yugoslavia

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Croatian Academy of Sciences and Arts

Never officially enforced or renounced, Lysenkoism in socialist Yugoslavia was propagated since 1945 and lingered on well into the 1950s, even after the Tito-Stalin Split precipitated an early and dramatic de-Stalinization. In 1954, Mirko Korić (1894-1977), biology professor at the University of Sarajevo who was forced to retire after students rebelled against his lectures in “formal genetics,” published a book, *Istina o T. D. Lisenku i njegovom učenju* (The truth about T. D. Lysenko and his teachings). By far the most sophisticated and comprehensive anti-Lysenkoist piece in Yugoslavia, the book illustrated the complexity of discussing Lysenkoism in post-Stalinist Yugoslavia. Instead of summarily dismissing it, Yugoslav

biologists and agronomists carefully differentiated between “deviated” and “sound” elements in the Michurinist biology. If the Yugoslav scientific leadership failed to protect Korić from militant students, he found an unlikely ally – the director of the department of Genetics, Carnegie Institution of Washington (now Cold Spring Harbor Laboratory), Milislav Demerec (1895-1966). Decades earlier, they had attended school in Croatia together. Acquainted with Korić’s situation, Demerec supplied and interpreted him with a variety of Western genetics and anti-Lysenkoist publications. The anti-Communist tone of many of these, however, made them problematic in the anti-Stalinist, yet still committedly socialist Yugoslavia. The paper will examine this and related examples of trans-Atlantic cooperation, focusing on the translation and usage of the Western anti-Lysenkoist efforts for specifically Yugoslav purposes in a time when Yugoslav scientific community drew ever more inspiration and resources from the

West, but continued to build a “socialist science.”

Biology | Europe | 20th century, late |
Lysenkoism, Cold War, scientific networks

Cold War Prevention: The Discourse of Hong Kong Flu and Its Controversies, 1968-1972

Xianliang Dong
City University of Hong Kong

1968 is often hailed as the year that “rocked the world.” However, this historical moment is barely evaluated from the realm of medicine. “Hong Kong Flu” pandemic, one of the three worldwide flu pandemics breakout in the last century, was caused by the virus H3N2 and had infected 15 percent of the whole population in 1968. Although its death rate was relatively low, it promoted a medical competition and negotiation between different institutions, from Hong Kong, Japan to the United States. Its breakout also changed the mentality of the world towards unexpected severe diseases. With a study of this case, this paper aims to answer three questions in medical history: 1. How to define “colonial” medicine in a homogenous decolonized era? 2. What could this Asian experience contribute to cold war medicine? 3. When and how did international

health transform to global health? Based mainly on articles from English and Chinese newspapers and government reports, this paper argues that a new mode of public health governance and the adoption of preventive medicine had emerged from a new civic discourse in 1968. The paper also seeks to outline an underlying ideological campaign, just after the riots in 1967, which relied on the metaphor of disease to segregate the communist community from its capitalist counterpart. As the flu epidemic spread around the world, the structure of the Cold War was stabilized. And finally, this paper will demonstrate a rise in local consciousness as Hong Kong became a frontier in the Cold War.

Medicine and Health | East Asia | 20th century, late | Influenza, Prevention, Hong Kong, Transnational, Mentality

Collecting Anatomy and Making Knowledge about Disease at Great Windmill Street: Matthew Baillie’s Morbid Anatomy

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University of Leeds

Fundamental to the work of William Hunter and his assistants at the Great Windmill Street school in London was the collecting of anatomical preparations. Not only were these preparations vital to teaching at the

school, their making provided visual and tactile information that was the basis for many of the anatomical discoveries associated with the school. Diseased body parts were collected as part of this anatomical work throughout Hunter's lifetime, as they were seen to provide insights into regular anatomy. This changed when Hunter's nephew, Matthew Baillie, took over the school (with William Cruikshank) and reconceptualised how the diseased parts there were understood as 'morbid anatomy', later publishing *The Morbid Anatomy* of some of the most important parts of the human body (1793), which was one of the most successful works of learned medicine published in the eighteenth century. In this paper I argue that Baillie's practice of morbid anatomy was fundamentally in keeping with the anatomical practices of the Great Windmill Street school; the tactile and visual information provided by the cadaver was prioritised above all else, but now for the subject of disease. This challenged typical practice in the study of disease, which included post-mortem examination of cadavers as part of case histories. In removing the temporal aspect from the study of diseased cadavers, Baillie argued

that diseased appearances could be generalised, not just singular, knowledge and therefore an anatomical subject in its own right.

Medicine and Health | Europe | 18th century | Matthew Baillie, morbid anatomy, sensory history, William Hunter

Colonial Science and Local Knowledge: Environmental Sleeping Sickness Control in East Africa, 1900-1920

Sarah Ehlers

Technical University of Munich

This paper addresses the transnational history of British, German, and Belgian colonial environmental action to combat sleeping sickness in East Africa. Following the discovery that vector-borne diseases and tropical environments were highly interrelated phenomena, colonial scientists and doctors developed disease control schemes that targeted not only pathogens and parasites but also their vectors, their habitats and their animal reservoirs. This new type of environmental disease control relied heavily on the local population and on their knowledge of their natural surroundings. This paper explores the scientific pursuit of this knowledge: what kind of data was collected, which categories were applied? How was this process

of understanding and conceptualizing nature embedded in colonial rule? In which ways was scientific inquiry dependent on local knowledge? Secondly, this paper deals with the mechanisms through which local environmental knowledge attained the status of evidence, and with shifting concepts of expertise in colonial contexts. How did European scientists interact with local healing cultures and indigenous knowledge? How did they present their findings to different audiences (scientific circles in Europe, colonial administration, local elites and inhabitants of infected areas)? In which ways did new forms of indigenous participation in science transform data acquisition and medical approaches in tropical medicine? Although colonial experts only rarely acknowledged indigenous knowledge in their publications, local expertise and agency mattered in many ways. Colonial health campaigns thus offer an exemplary domain of environmental interventionism for exploring the connections between Western and

colonial sciences, local knowledge and the history of colonialism.

Earth and Environmental Sciences | Africa | 20th century, early | sleeping sickness, trypanosomiasis, Lake Victoria, tropical medicine, tsetse-fly, indigenous knowledge

Colourless Writings of Statisticians and Their Distant Readers: Creating a New Mode of Reading in the Journal of the Statistical Society of London, 1838-1858

Yasuhiro Okazawa
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Established in 1834 for the collection of facts, the Statistical Society of London (SSL) played a central role in the moulding of statistical facts. The SSL defined statistical facts as the aggregation of numerous observations and reduced the value of single observations to isolated facts that alone could not be accepted as evidence. For the production of statistical facts, the SSL promoted two measures: conducting a coordinated observation to collect new facts and gleaning facts from existing literature. While the SSL left the former to governments, it devoted its resources to fostering the latter. To fulfil this mission, the Journal of the Statistical Society of London (JSSL) was created in 1838 as a virtual

storehouse of existing facts where one could find facts of interest. The JSSL allowed individuals to share their small-scale observations for further aggregation as well as to publish statistical tables compiled from scattered facts that were already published elsewhere. As with its contemporaries, the JSSL was designed to serve posterity, which led the journal to include what apparently bore little importance at the time but might be of interest to readers in the distant future. The journal's scientific missions resulted in the JSSL's acceptance to publish colourless articles that provided no hypothesis, no conclusion and even no 'original' data. This paper explores how the new concept of facts in statistics shaped the practice of writing and reading among statisticians through the examination of the JSSL's creation.

Social Sciences | Europe | 19th century |
statistics, data, note-taking

Commentary as an Epistemic Genre: Making and Transmitting Knowledge in 15th ca. Islamic Astronomy

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Ulugh Beg's 15th c. Samarqand observatory and associated madrasa is one of the most famous Islamic scientific institutions, producing astronomical observations that were not equalled until Tycho Brahe. Less is known, however, about the process of research and education at Samarqand, but a number of commentaries produced by Samarqand scholars shed light on the intellectual life of the classroom and the role of patronage in scholars' careers. In this paper, I explore the ways in which such commentaries reflect a critical engagement with problems in theoretical astronomy as well as the educational practices of Ulugh Beg's madrasa. I argue that commentaries functioned as a means of making as well as transmitting astronomical knowledge, highlighting how commentaries served to fulfill both research and teaching goals within the context of an Islamic educational institution. I draw examples from the works of three scholars: Qadizade

al-Rumi, observatory director and Ulugh Beg's personal tutor, who wrote a commentary on the *Almagest* and whose commentary on a popular elementary astronomy treatise became a widely-used intermediate textbook in Ottoman madrasas; Qadizade's student Fathallah al-Shirwani, who wrote a supercommentary on Qadizade's textbook in addition to his own commentary on Nasir al-Din al-Tusi's famous work of theoretical astronomy; and Ali Qushji, a close companion of Ulugh Beg who later became head of the Ayasofya madrasa in Istanbul under Sultan Mehmed II, and who wrote commentaries on cutting-edge theoretical astronomy and philosophical theology in addition to his own works on mathematics.

Physical Sciences | Near and Middle East | Renaissance | astronomy, mathematics, cosmology, commentary, Islamic science, science education, scientific genres

Communities of Molecular Storytelling: Libraries, Journal Clubs, and Seminars in the Making of Modern Epigenetics

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“I can date very precisely the moment when I conceived the idea of maintenance methylation and its

use to remember patterns of DNA modification and control gene expression” wrote John Pugh, a ‘father’ of modern epigenetics, in a letter: “This was on 14 March 1973 at 5.20 pm in the seminar room at NIMR.” Histories of science have long dispensed with the notion of a solitary genius, showing the importance of work in a couples and laboratory teams. Expensive pieces of equipment in ‘big science’ fostered novel forms of labour organization and new communities. But what of those tools somewhere in-between – and in particular those less tangible and ephemeral? Using the case of early history of epigenetics (between 1970-1975) and drawing on the interviews with its founders, Arthur Riggs in California and John Pugh in London, I bring to light the invisible web of tools that sustained research communities: journal clubs and seminars. Often without a fixed location, they consisted of not much more than chairs, a slide projector and a pot of tea with biscuits; required no skills beyond reading, listening, conversing, storytelling. I examine the work and care invested into building and maintaining these tools, rules that guided them, and the ways in which they interacted with

other places of research, in particular laboratory. By giving these ‘communities of storytelling’ their place in history, this talk will stress the need to approach scientific innovation through the lens of sharing rather than competition and priority disputes.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | epigenetics, genetics, community, care, journal club, library, storytelling, National Institute of Medical Research, London, California Institute of Technology, City of Hope, 1970s

Comparing Latin and Islamic Contexts of Teaching and Learning Astrology in the Medieval Period

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University of Oklahoma

What was the role of astronomical tables as pedagogical tools for the teaching of astrology in the medieval period? In considering the genres of texts used for teaching astrology in Islamic contexts, the introductory text (*mudkhal*) was a central component of study. Oftentimes these introductions make reference to a table of planetary motion (*zīj*), where one may find explanations for performing technical calculations of mathematical astrology. Similarly, in the medieval Latin tradition,

planetary tables included sets of instructions or canons (*canones*) which provide details on astrological calculations. European students would also read Latin renditions of the Arabic introductions. This paper examines John of Saxony’s canons to the Alfonsine Tables and his commentary to Alcabitus’s *Introduction to Astrology* in order to reconstruct how astrological techniques were taught in the fourteenth-century at the University of Paris. By comparing this analysis with the relationship between introductory texts and tables in the Islamic world, we may better assess the importance of astronomical tables in the teaching and learning of technical astrology in both cultures. Furthermore, this comparison also raises the question of the impact of the institutional setting of universities on the formalization of some aspects of astrological pedagogy.

Physical Sciences | Global or Multilocal | Medieval | medieval, astronomy, astrology, Latin, Islamic, European, Arabic, pedagogy, comparative

Conceptual Change in Early Modern Practical Geometries

Antoni Malet

Universitat Pompeu Fabra, Barcelona

As recognized by a growing body of literature, most conceptual and methodological shifts in early modern mathematics cannot be accounted for in terms of internal theoretical developments. On the contrary, this literature suggests, social and institutional contexts and the social practices of arithmetic, geometry, and metrology provide inputs that may explain the momentous transformations mathematics went through in early modern Europe. This paper analyses some 16th-century practical geometry books that contain theoretical innovations — as compared to contemporary authoritative editions of Euclid's *Elements*. It pays particular attention to old notions (such as ratio and curve) that were newly defined, to new ideas (such as measure) that were introduced as if they were old ones, and to new methods (such as the use of material instruments) that were legitimized in practical geometry books. By paying attention to them the paper aims to document ways in which mathematical innovations “sneaked in” so to speak

into the established, ordinary, authoritative body of mathematical results. The emphasis is not only on documenting new concepts and methods connected to social practices, but also on analyzing how practice and practical tools added legitimacy and authority to new concepts and new methods.

Mathematics | Europe | 17th century | Practical geometry, textbooks, Euclid, social history of mathematics

Connection and Disconnection in the Global Scientific Imagining of the Himalaya

Lachlan Fleetwood

University of Cambridge

It was for both science and empire that East India Company employees lugged (or rather, employed Asian porters to lug) a panoply of fragile instruments into, and specimens out of, the Himalaya in order to account for what were only just coming to be acknowledged were by far the highest mountains on the globe. Measuring altitude accurately had never really been necessary before, but elevation was becoming a critical variable in many sciences, especially biogeography, altitude physiology, and geology. This scientific engagement with three dimensions was nevertheless complicated by surveyors'

dependence on their guides and the limits of imperial mastery along nascent high mountain frontiers. By focusing on the first half of the nineteenth century, often overlooked for the later period, I show that the gradual accumulation of scientific, political and imaginative coherence in the Himalaya occurred simultaneously with a recognition of the commensurability of mountain environments. Mountain science was thus, I argue, always global science. This had both a material dimension in the movement of things – specimens, scientific instruments, inscriptions and drawings – and an imaginative dimension in the way that plants, fossils and bodies increasingly had to be located on globe that was vertical as well as round. Practising science was thus an inherently comparative process, and even while physically ascending into the Himalaya, surveyors had to engage with a vertical globe that already prominently featured the Alps and Andes, even if tracing these equivalencies sometimes

caused more confusion rather than coherence.

Aspects of Scientific Practice/Organization | Global or Multilocational | 19th century | Exploration; empire; frontiers; global science; Himalaya; instruments; mountains; scientific practice

Consent Decrees, Public Knowledge, and Empiricist Constructivism: Revisiting Lost Perspectives on Science and Democracy in the Global 1970s

Sarah Bridger

California Polytechnic State University

In the mid-1970s, the Black Panther biochemist Curtis Powell pledged to publish his research only in African journals, in order to force western acknowledgment of African science. Five years before the publication of Bruno Latour's *Laboratory Life* (1979), Powell was drawing on a precise understanding of how cycles of credit and credibility operated in the production of scientific knowledge. Unlike Latour, however, Powell's epistemological analysis was deeply grounded both in his commitment to black radical politics and his faith in empirical research. Back in the United States, Indian-born chemist Sheila Rajender's class action lawsuit against the University of Minnesota secured a historic consent decree requiring oversight

of university hiring. Her case exemplified a key moment of anti-essentialist federal intervention for women in science. But the promise of Rajender's approach was short-lived, as the election of Ronald Reagan and subsequent elevation of Clarence Thomas as the new head of the EEOC quickly made clear. Across the Atlantic in England, the biologist Cesar Milstein, pioneer of hybridoma research, warned against intellectual property regimes that would turn basic research into a "profit-seeking enterprise." He shared his work widely, even with competitors who promptly sought their own patents and profits. Milstein's views thus stood in stark contrast to both Margaret Thatcher's nationalist science priorities and the emerging biotech industry in the United States. All three of these figures embraced alternative visions of the democratization of science; recovering their lost perspectives yields insights into the politics of 1970s science and the controversies of today.

Thematic Approaches to the Study of Science |
Global or Multilocational | 20th century, late

Constructing Humphry Davy's Biographical Image

Frank James

University College London and Royal
Institution

This paper, which is also a contribution to the somewhat understudied area of the history of biography, discusses a couple of short accounts of the life of the English chemist Humphry Davy (1778-1829) and the three major biographies published in the years following his death. These latter were an 'anti-biography' by John Ayrton Paris (1831) and two admiring biographies by Davy's younger brother John Davy (1836, 1858). By examining the processes surrounding their writing and publication, including the involvement (or rather lack thereof) by his widow, Jane Davy, this paper will illustrate how Davy's biographical reputation was constructed. Furthermore, this approach reveals how his surviving manuscripts and related documents came to be collected and preserved and so help us understand the effects they continue to exert on our understanding of Davy in particular

and nineteenth-century science in general.

Thematic Approaches to the Study of Science | Europe | 19th century | Humphry Davy, Jane Davy, John Davy, John Ayrton Paris, history of biography, publishing history, book history

Contested Cooperation: The US-South Korea Ecological Survey in the Demilitarized Zone, 1963-1968

Jaehwan Hyun

Max-Planck-Institute for the History of Science

How international scientific cooperation played out in Cold War politics and knowledge production has been a central concern for historians of science. The connection between U.S. or Soviet technical assistance and the rapid development of science in East Asia has been noted in this context. This panel sheds lights on unexplored but central questions connected to this issue: What did “cooperation” mean to actors in the Cold War context? What socio-political conditions and material infrastructure made cooperation available or led to failure? Wasn’t regional cooperation within East Asia important as much as aid from superpowers? Hyun examines how the notion of cooperation was contested, negotiated, and redefined between

South Korean and the U.S. scientists conducting ecosystem ecology research in the Korean demilitarized zone during the 1960s. DiMoia illuminates how Japanese and South Korean parasitologists revitalized their colonial medical network in the name of development aid projects after the normalization of diplomatic relations in 1965. Luk looks at an international oceanographic project known as “Cooperative Study of the Kuroshio and Adjacent Regions” (1965–1978) and reveals the politics of international cooperation and competition between Chinese and Japanese scientists. Barrett explores the rhetoric and reality of regional cooperation in the planning and execution of the 1964 Peking Science Symposium, discussing China’s efforts to establish itself as the central scientific power in the developing world. Bringing together diverse cooperative projects, this panel provides opportunities to rethink the nature of scientific cooperation in Cold War East Asia beyond the history of technical aid.

Thematic Approaches to the Study of Science | East Asia | 20th century, late | The politics of international cooperation, global Cold War, East Asia

Continuity and Change in the Italian Regimen, 1650-1800

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Independent Historian

Despite medical advances, healthy living advice in the eighteenth century conveys a strong impression of continuity with the regimen genre from the late-middle ages and Renaissance. Indeed, most continued to be informed by a Galenic understanding of the body, particularly as regards the framework of the six non-naturals. Drawing on my previous research on the vernacular Italian regimen between the 1480's and the 1650's this paper will explore shifts in the genre by examining a number of Italian medical texts published after 1650 and before 1800. These are either explicitly 'regimen' or other medical tracts which include advice on how to live healthily, avoid illness and extend one's life, such as Ramazzini's much republished and widely translated 'On the Diseases of Tradesmen'. On the one hand I will aim to explore some of the broader trends, such as the ever-increasing focus on the importance of the air to health, and an apparent decline in the emphasis on exercise. On the other hand I will focus on some more nuanced developments

within these broader changes, such as in their understandings of, and advice pertaining to, the management of the air and the role of the skin in health.

Medicine and Health | Europe | 18th century

Correcting Life through the Marketplace? The History of Genome Editing and Academic Capitalism in South Korea

Doogab Yi

Seoul National University

This paper examines a scientific career of one of the most prominent genetic engineering scientists in South Korea, Dr. Jin-soo Kim. As he often introduces himself, he is "an entrepreneur and chemist-turned-biologist." He is quite renowned for his work on genome editing at Seoul National University, and for his founding of ToolGen, one of the largest gene editing companies in South Korea. I will follow his career within the context of the rise of academic capitalism in South Korea. I will first examine his early career from a research scientist at a private research institute to a founder of a biotech company within the context of the rise of the venture capital industry in South Korea. The Korean government, faced with an economic crisis, tried to promote venture

business to restructure the Korean industry. Then I will analyze his return to an academic post at Seoul National University in the early 2000s, at a time when the university tried to institutionalize academic capitalism. In many ways, his return came to be regarded as an attempt to correct academic life toward economic development. By 2014, he has emerged as one of the most prominent entrepreneurial scientists at Seoul National University, directing cutting-edge research teams both at the Institute for Basic Science and ToolGen. By reflecting on his boundary crossing between the academy and industry, this paper ends with a brief discussion on a recent controversy over the ownership of the CRISPR patents development at Seoul National University.

Biology | East Asia | 21st century | Academic Capitalism, Biotechnology, Genome Editing, Ownership and Patenting

Cranial Compatibility: Phrenology, Measurement, and Marriage Assessment

Carla Bittel

Loyola Marymount University

This paper demonstrates how phrenological tools of character assessment were used to measure marriage compatibility in the

nineteenth century. It will examine how the knowledge and practices of cranial measurement produced character “profiles” for the purpose of judging suitable marriage partners. A popular but contested science of the mind, phrenology articulated a relationship between the mental and the physical, and maintained that one could truly know others and oneself through measuring “organs” of the mind, or protrusions on the skull. While much has been written about phrenology, less attention has been paid to its focus on marriage, mating and motherhood, and how its epistemic practices supported a model of courtship based on numerical and empirical assessment of gendered and racialized character traits. Focused on the North American context, this paper will use phrenological materials -- advice literature, personalized charts, photographs, mail order submissions and testimonials -- to illustrate how phrenology packaged cranial knowledge, promoting it as superior to other forms of matching. Many “practical” phrenologists claimed expertise on marital harmony, and sold their analyses as more accurate and reliable than personal experience or familial knowledge.

Many consumers pursued this knowledge, hoping to find a partner with compatible crania, but more often to assess themselves and the fitness of a current suitor or spouse. Ultimately, this paper will show that notions of race and gender, heredity, and sexual “relations” were embedded in the shorthand of phrenological measurements.

Medicine and Health | North America | 19th century | gender & sexuality, ethnicity & race, instruments & measurements, phrenology, 19th century, social science, technology, medicine

Creating Feed for Meat: The Science of Feeding Animals in Industrial Farms (1954-2019)

Floor Haalboom

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Pigs, chickens and cattle in factory farms need to eat. A lot. Millions of tons of feed are shipped across oceans to make industrial livestock production possible. This creates global problems, like deforestation in the global south, manure surpluses in the global north, and competition between animal feed and human food production. Until now, historians have neglected the history of livestock feed, especially in comparison to the human diet. The aim of this paper is to show the

crucial importance of livestock feed as a scientific technology. Feed contributed just as much to the rise of industrial agriculture as chemical fertilizers, pesticides, mechanization and new breeds of plants and animals did. This paper focuses on one small country with a particularly intensive industrial livestock sector: the Netherlands; and on the period of significant intensification of this sector: the second half of the twentieth century. Lacking the land to produce the massive amounts of feed needed for these new ‘factory farms’, the Netherlands imported most of it – like soy and fish meal from Latin America. These commodities ended up in a new kind of feed: ‘compound feed’. Animal scientists were decisive for creating the best and cheapest compound feeds in order to maximize animal productivity – with major social-economic, environmental, welfare and health consequences for human and non-human animals across the globe.

Thematic Approaches to the Study of Science | Europe | 20th century, late | industrial livestock, agricultural science, technology, environmental history

Crossing Shallow Seas: Muddy Imaginaries in the Age of Exploration

Christopher L. Pastore

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This paper examines the environmental history and cultural geography of the Atlantic during the Age of Exploration. How, it asks, did early modern oceanic imaginaries shape the contours of European expansion and cultural contact? From the ancient period through early modernity, numerous commentators posited that the Atlantic was a shallow, swampy place swirling with seaweed and debris. And this informed their ideas about Native American origins. As late as 1743 the American naturalist and explorer John Bartram concluded that America had been peopled not by way of heroic ocean passages, but via incremental advances. The seas surrounding North America, he concluded, could be better described as filled with networks of islands, gulfs, and capes that could be traversed step-by-step with minimal scientific expertise. Among Bartram's seas—small, contained, and easily navigated

stretches of water—the shore loomed large. An archipelagic America, in other words, was deeply connected, culturally and geographically, to the rest of the world. Drawing on the accounts of early modern explorers, naturalists, and cartographers, this interdisciplinary look at how culture, ecology, and geography became firmly entangled reveals that the material and conceptual complexities inherent in oceanic spaces played powerful roles in creating new human networks and identities.

Earth and Environmental Sciences | North America | 17th century | shallows, ocean, crossing

Cultivating Resistance: Ethnoecology, Anticolonialism, and Indigenous Territoriality in Twentieth-Century Southeast Asia

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Over the course of the twentieth century, highland Southeast Asian indigenous societies grappled with the incursions of diverse Western imperial interests and, later, with the more imminent colonization endeavours of newly independent, development-oriented nation states. Disparaging ethnographic

assessments of indigenous agriculture and subsistence practices frequently served as justifications for these undertakings. As the century wore on, Western anthropologists adopted more appreciative views of indigenous agrarian lifeways - a shift usually explained as a result of anthropology's gradual movement away from tiered classificatory approaches toward a Boasian emphasis on the functional sophistication of indigenous cultures in relation to their environments and histories. Focusing principally on the work of Harley Harris Bartlett (1886-1960), a University of Michigan botanist, plant ecologist and ethnographer who analyzed indigenous ethnoecology in interwar Sumatra, and Harold Conklin (1926-2016), a Yale-based ethnobotanist and ethnoecologist of the post-World War II Philippines, this paper instead explores the role played by Batak, Hanunóo and Ifugao strategic priorities in helping to revise this anthropological perspective. I also examine how Conklin's self-consciously anticolonial stance on Philippine indigenous swidden and terrace agriculture was shaped by Native American-led activism. In addition to situating Southeast Asian

indigenous territorial colonization at the temporal juncture of imperial and national projects of dispossession, then, this paper also analyzes American ethnoscientific reassessments as the partial cumulation of indigenous anticolonial efforts that were trans-Pacific in their reach and influence.

Earth and Environmental Sciences | Southeast Asia | 20th century, late | Ethnoecology, anthropology, Sumatra, Philippines, colonialism, imperial science

Culture, Trauma, and Confinement: The Making of Psychiatric Knowledge in Refugee Camps

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This paper will examine the history of psychiatry through the lens of the refugee camp, which, I argue, has served as an instrument of accumulation and extraction of knowledge about refugees and their mental (ill)health. Though the voices of refugees are often absent from the psychiatric knowledge created about them, they have nonetheless contributed to and shaped subfields of psychiatric knowledge and practice, such as trauma psychiatry and transcultural psychiatry. Two very different mental health programs delivered by medical

humanitarian organizations to Cambodian refugees encamped on the Thai-Cambodian border will be examined, from both the earlier and later years of a humanitarian border crisis that lasted from 1979-1993. Different psychiatric methodologies were introduced, applied, and refined in Cambodian refugee camps, contributing to the genesis of 'new' fields of 'refugee mental health' and 'refugee trauma'. The first of these programs involved the appropriation of indigenous knowledge by the International Committee of the Red Cross (ICRC), which eschewed Western psychiatric concepts completely in favour of Khmer traditional medicine. ICRC set up and administered Traditional Medicine Centres that were staffed by krou khmer, Cambodian Buddhist monks, who practiced their indigenous healing traditions within the framework and limitations set by ICRC. The second involved a landmark study by the Harvard Program in Refugee Trauma, which introduced and applied new Western psychiatric tools, such as the DSM-III, and diagnoses, like PTSD, in

Site 2, the largest camp on the border.

Medicine and Health | Southeast Asia | 20th century, late | refugee mental health, psychiatry, refugee camp, trauma, culture, public health, humanitarianism

Curation and Care: Maintaining Community Collections in *Drosophila* Genetics

Jenny Bangham
University of Cambridge

Geneticists rely on working collections of data and of living organisms. Databases capture, order and communicate standardized genetic information, while stock centres make available vast arrays of standardized yeasts, bacteria, viruses, plasmids, cell cultures, animals and plants. Collections of both data and living organisms require dedicated professionals and practices of on-going care, curation, and funding, all of which keep such collections valuable and accessible to their biologist users. This paper deals with the collections of data and animals used by fruit fly geneticists. Since the 1920s, *Drosophila* researchers have depended on institutions devoted to collecting and distributing living mutant and transgenic fruit flies. From the 1930s, a newsletter (*Drosophila* Information Service) distributed lists

of mutant stocks held in labs around the world, and from the 1940s, researchers used on book-length ‘mutant catalogues’, which systematically listed all known information about *Drosophila* mutants. During the 1990s, these living and text-based resources were linked through ‘FlyBase’, an online database that made available cross-referenced tables of gene mutants, bibliographies, lab addresses, and resources for obtaining mutant flies. This paper explores the practices that *Drosophila* database curators, editors, stock keepers and collections managers deployed to keep such living and text-based ‘community tools’ valuable and accessible. It reflects on how those professionals interpreted and negotiated the needs of diverse research ‘communities’, and argues that the practices of care and maintenance that they developed in turn shaped scientific relationships and methods.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 20th century, late |
curation, care, stock centres, databases

Curving the Pelvis: André Levret and the Obstetrical Forceps

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UCLA

Obstetrical forceps loom large in the history of midwifery as the explanatory mechanism for the emergence of routine male attendance on uncomplicated labors. The forceps, however, were a dynamic object that underwent constant modifications, with incongruous versions often coexisting. In 1751 celebrated man-midwife André Levret (1703–1780) published a new design of the forceps with a pelvic curve, developed from measurements of pelvic proportions. He initiated a geometric conception of childbirth based on planes and angles that remains in use today. Levret succinctly summarized his conception of childbirth as “a natural operation, truly mechanical and susceptible to geometric demonstration.”[1] This theoretical conception of the female body materialized in his curved forceps. Scrutinizing Levret’s books, memoirs, images, and an annotated student copy of Levret’s textbook, this paper focuses on sociomaterial practices around his forceps to explore the confluence of Levret’s

medical practices, his curved forceps, and the birthing bodies of women. Finally, the paper follows Levret's forceps as they circulated around France, eventually finding their way into midwifery courses for provincial women. While the curved forceps developed from a particular, mechanistic conception of the birthing body, this theoretical perspective did not necessarily travel with it. My account also challenges the gendered, progressive narrative of the history of the forceps by demonstrating the indefinite path of invention and complicating the association of the forceps exclusively with men. [1] André Levret, *L'art Des Accouchemens, Démontré Par Des Principes De Physique Et De Mécanique*, 3rd ed. (Paris: Chez p Fr Didot le jeune, 1766), 86.

Medicine and Health | Europe | 18th century | instruments, forceps, midwifery, body, France

Cytogenetic "Plasmas," Hereditary Elements Revisited, and the Sonderweg of Botanical Genetics

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ICI Berlin Institute for Cultural Inquiry

What did it mean for something to be the "material basis" of life, or heredity, permeability, or

metabolism before molecular biology? What conceptions of matter did biologists rely on as they tackled new research topics? In the latter half of the nineteenth century (and well into the twentieth) it was biological orthodoxy that protoplasm was the "material basis of life," so much so that the protoplasm's protean nature spawned what Robert Brain has called "protoplasmania"—an aesthetic, cultural, and scientific obsession with the so-called "living substance." But life was not the only thing biologists in the nineteenth century studied, and in this paper I will show how other areas of biology even more particular "plasmanias" took hold, as other vital phenomena gained their own "plasms" in due course. The idioplasm, germ plasm, nucleoplasm, stereoplasm, endo- and ecto-plasms, even cytoplasm, became the calling cards for newly emerging (and contested) problem areas in cellular anatomy and physiology. In particular, I will argue that botanists, far more so than zoologists, insisted on tying hereditary and developmental phenomena to their material bases within the cell. From the beginning with Carl Nägeli's idioplasm theory,

botanical theories of “genetics” always made reference to the material reality of hereditary factors via physical chemistry—albeit a physical chemistry specific to plant physiology. By shifting the historiographical locus of cell theory and hereditary theory to the history of botany, I will show how hereditary theory encountered chemical theory, several generations before the revolution in molecular genetics.

Biology | Global or Multilocational | 20th century, early | heredity, cytology, genetics, botany, material basis of life

Data Rituals: Measurement of Height and Weight in Baby Books, 1872-1940

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This paper looks at records of baby height and weight in baby books in the US between 1872 and 1940.

Baby books, books in which parents record information about their child, are still a familiar object in households with young children.

Baby books, this paper shows, are a unique source in which we can follow practices of measuring and quantification from the doctor’s office and the health departments into the household. Although the use of weight and height records by

parents might appear to exemplify institutional biopower manifested through internalised self-monitoring, I argue that keeping a record of baby’s growth in a baby book was, in fact, a ritualised version of measurement. Using both work by historians of science on quantification, and anthropological literature on ritual and selfhood, I argue that this ritual of measuring and recording both symbolised and realised the transformation of the baby from newborn status to child and new personality in the family. With the transfer from medical protocol to family practice in baby books, the recording of height and weight thus took on a radically different meaning.

Thematic Approaches to the Study of Science | North America | 20th century, early | history of medicine, baby books, quantification, self-tracking

Dead Animals, Past and Present: Photography and Fossil Knowledges in Johannes Weigelt’s Recent Vertebrate Carcasses and Their Paleobiological Implications

Ana María Gómez López

Independent scholar

Johannes Weigelt (1890-1948), a German paleontologist and geologist, was the first proponent of

taphonomy—the study of the decay, burial, and fossilization of biological organisms. In the mid-1920s, while performing fieldwork in the U.S. Gulf Coast, he came across scores of dead cows, birds, fish, alligators, and amphibians. Many of these creatures died as a result of extreme weather storms, their remains marooned and weathering in coastal beaches, river banks, and mudflats. Weigelt considered that the physical processes affecting these animals were analogous to those that preserved Miocene fossil specimens housed at the Martin-Luther-Universität in Halle-Wittenberg, where he was a geology professor. He photographed dozens of these decomposing animals during his travels throughout Texas, Oklahoma, and Louisiana, setting these images alongside sketches of fossils recovered from central Germany in his 1927 book *Recent Vertebrate Carcasses and their Paleobiological Implications*. This ground-breaking monograph and its visual juxtaposition of post-mortem processes in contemporary and long extinct animals became a key reference for paleontology, as well as for archaeology, forensic science, and physical anthropology. This paper will present Weigelt's

photographic and field-based research in taphonomy on both sides of the Atlantic, focusing on how animal remains from the present and distant past served as concomitant sites for scientific and image-based knowledge production alike.

Thematic Approaches to the Study of Science | Europe | 20th century, early | Dead animals, photography, paleobiology, taphonomy, fieldwork

Deceleration: Biogeography, Snails, and the Temporality of Landscapes, ca. 1900

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ETH Zurich

In the late 19th century many biologists in Central Europe turned to the field of malacology, the study of snails and other molluscs. In a period when global environments changed tremendously due to human intervention and the growth of global transport and economy, many biologists believed that snails with their sluggish pace would allow them to turn back time. What became visible by studying snails, they thought, was a different temporality of nature: its original state. The rise of malacology as a paradigmatic subfield of biogeography reflected a fundamental shift, which was truly international: the 'discovery' of time

as a fundamental factor of determining the distribution of species. By concentrating on the local example of malacology in the Frankfurt region by 1900, this paper argues that the temporalization of biogeography in Central Europe (and elsewhere) was not only caused by the rise of evolutionary theory, but also closely linked to a rapid modification of environments. Industries and their infrastructures substantially changed the biological composition of landscapes, and their construction sites allowed naturalists to observe history and deeper layers of time on an unprecedented and unexpected scale. As a result, the gap between a well-stored past and a rapidly changing present seemed to widen constantly. In the German-speaking context, this reconfiguration of time became manifest in the notion of “home” (Heimat), an alleged Ur-state of nature and culture where all creatures had allegedly stayed at the place where they “originally” belonged.

Earth and Environmental Sciences | Europe | 20th century, early | deep time, objects of temporality, biogeography, industrialization, infrastructures

Decolonizing Medicine and Science in North Africa

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Max Planck Institute for History of Science

Since the nineteenth century, medicine and science have been perceived as a monolithic tool for domination, inextricably linked to Europe’s imperial expansion into the Middle East, Africa, and Asia. To that end, nineteenth- and twentieth-century colonialism resulted in medical and scientific materials from North Africa residing in European archives, institutes and museums, thus hardening racial boundaries and imbricating coercive medical and scientific archives. This paper examines how non-elite North Africans functioned as mediators, co-producers, and resisters of these colonial dynamics in medicine and science. At the same time, it will consider how Arab/Islamic and traditional knowledge were integrated into global epistemologies of medicine and science. Emerging from a point of decolonial and anti-colonial methodology, this paper will narrate the medical/scientific lives from Egypt and Tunisia that currently reside in European institutes as well as those that previously resided at the Institute of Egypt. The paper will articulate the

conditions of possibility for how these artifacts, knowledge systems, and people undergo a series of cross-cultural exchanges undergo colonial and postcolonial contexts. More specifically, it will investigate the funding, production and circulation of science, highlight the dynamism of “traditional” science, and the syncretism of knowledge traditions.

Theoretical Approaches to the Study of Science | Near and Middle East | Cultural and cross-cultural contexts, including colonialism in general | decolonial, archives, medicine, science, museum

Dedications in Early Modern Scientific Books

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University of Oklahoma

In the early modern period, most scholarly works (as well as many maps, instruments, etc.) included a printed dedication. Historians of science have studied such dedications mainly as a window on patronage relationships. That aspect is important, but cannot be the whole story. After all, most reeditions still included the original dedications, even when at the time of publication the original dedicator and dedicatee were long dead. In this paper, I will offer a more nuanced view on the function of dedications. I will briefly discuss the

genre in general and present some concrete examples, notably the work of the Dutch mathematician (and contemporary of Galileo) Simon Stevin. It will appear that the function of dedications was much more ambiguous than is often assumed.

Aspects of Scientific Practice/Organization | Europe | 17th century | Dedications, Patronage, Scientific Publications

Deinstitutionalization: The Dutch way?

Joost Vijselaar

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Inspired mainly by the example of Italian ‘Democratic psychiatry’, around the mid-nineteen eighties, the policies of both Dutch government and the field of mental health care turned towards the aim of deinstitutionalization. Official governmental directives included the gradual dismantling of some of the larger mental hospitals, the increase of the number of sheltered homes, and the introduction of e.g. assertive community treatment and rehabilitation. These contributed to a shift towards community psychiatry during the nineties. Nevertheless, at the beginning of the 21st century, the Netherlands figured amongst the European countries with the highest

number of institutional beds. The reasons for the ‘lagging behind’ or the different pathway of Dutch mental health care are still a matter of discussion and a subject for historical research. Some possible causes can already be hypothesized. Around 1970 Dutch institutional mental health consisted of medium-sized psychiatric hospitals with comparatively high standards of care. Starting during the 1920s, the Netherlands had a pioneering role in the development of a nationwide system of community psychiatry, which probably resulted in a situation in which the pioneer is lagging behind once all the others followed. Furthermore, parallel and interfering developments in society and government policies during the last decades of the 20th century – e.g. the demise of the welfare state and the liberalization of health insurance – had a negative effect on the reorganization of mental health care. In this paper the development of deinstitutionalization in the Netherlands will be analyzed against the background of the international historiography on this subject, aiming both at the distinction of different (national) models and phases in the history of the transfer

of psychiatric care to the community.

Medicine and Health | Europe | 20th century, late | anti-psychiatry, mental illness, deinstitutionalization, community mental health.

Designing for Diabetes: Objects, Practices, and Marketing of Diabetic Self-Monitoring Apparatus in the Second Half of the 20th Century

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Brock University

This paper traces the development and diversification of apparatus for monitoring and tracking blood sugar levels for diabetes. With the discovery and introduction of insulin in the 1920s, juvenile diabetes went from a certain death sentence to a manageable chronic disease, but one that required constant monitoring. Expertise and responsibility for monitoring began to shift early from medical professional to diabetic patient, and from the late 1930s, simplified urine sugar test kits enabled diabetics to self monitor and track their daily sugar levels. Diabetes management changed radically in the 1980s, with the development of simple, relatively affordable apparatus for monitoring blood sugar levels directly and in real time. This coincided with the

beginning of a rapid rise in diabetes rates in Western countries, driven largely by increasing rates of type II, or adult-onset diabetes. This paper will show how the glucose meter systems that were designed and marketed in the final decades of the 20th century embody assumptions about diabetic individuals and their bodies, but also how the changing demographics of glucose metre users led designers to modify their apparatus to adapt them to various lifestyle needs, preferences, and skills capacities. Analysing key apparatus and equipment, this paper explores their design and surrounding practices and what they reveal about intersections between the demands, constraints, and co-constitution of users and apparatus.

Medicine and Health | North America | 20th century, late | material cultures, medical artifacts, self-monitoring, history of medicine

Disability Materiality

Jaipreet Viridi
University of Delaware

As Katherine Ott has asserted, disability is “unique in the extent to which it is bonded with technology, tools, and machines as a medium of social interaction.” Objects used by, and made for, disabled people serve as tangible evidence of lived

experiences of disability—the constraints of medicine, the limits and expansions of technology, and shifting aspects of identity, self-representation, and stigma. These objects also define and shape social and medical meanings of “disabled” and “abled” as much as the relationship between innovation and commercialization. Furthermore, as scholars of material culture have emphasized, object biographies—especially of neglected artefacts—can dictate patterns in larger historical trends. Focusing on hearing prosthetics, this paper examines how material culture and the history of medicine provide methodological approaches for understanding neglected and nuanced histories of disability.

Medicine and Health

Disciplining Genetics: An Analysis of the Fifth International Congress of Genetics in Berlin, 1927

Ida Stamhuis
Vrije Universiteit Amsterdam

My paper will demonstrate how the character and the content of a discipline at a moment that it seems to have become a solid and accepted one, are still under vivid discussion. When the Fifth international meeting

of geneticists in 1927 in Berlin took place, participants felt that genetics was now an established and accepted discipline. The organizer, the German Ernst Baur, stated that it had grown from an unimportant outpost to one of the most important biological disciplines. This importance was reflected in its relevance for eugenics and medicine and for the breeding of useful plants and animals. According to the British geneticist Reginald Punnett, genetics had gained a central position in biology thanks to its interdisciplinary character: it linked systematics, physiology, biochemistry, and *Entwicklungsmechanik* (developmental mechanics). Others argued, in turn, that its focus and techniques had become too narrow and that it needed to broaden its scope to be able to answer relevant questions. According to the Austrian Richard von Wettstein, genetics should step out of the narrow Mendelian framework to explain evolution and to include plasmatic inheritance and the inheritance of acquired characteristics. The German Richard Goldschmidt argued that not only the transmission of genetic factors but also their action through development had to

be taken into account. Must the conclusion be that an established discipline can only remain strong when its adherents are conscious that its content and character are in a constant state of flux?

Biology | Global or Multilocational | 20th century, early

Disciplining the Environment: Ventilation and Prison Reform in Britain, 1750-1800

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For this session, I will present a selection from my dissertation, “Ventilating the Empire: Environmental Machines in the British Atlantic World, 1700-1850.” My overall project proposes that efforts to improve air quality have a significant history that pre-dates the industrial revolution. Alarmed at the high mortality rates of sailors, miners, and prisoners who breathed “close, confined, putrid air,” British experimenter and clergyman Stephen Hales (1677-1761) invented new “ventilators”: hand-or-wind-powered bellows to freshen enclosed atmospheres. Hales’ ventilators were fixed inside ships, prisons, hospitals, and even the House of Commons. My dissertation asks how natural-philosophical ideas about climate,

the environment, and human health were embodied in these devices and how the politics of ventilation evolved in Britain, France, and the United States during the long eighteenth century. The paper I will present examines the uses and abuses of ventilating machines in British prisons. First installed at the behest of Stephen Hales, these machines were specially modified to endure the strains placed on them by the unwilling prisoners who were tasked with their operation. Over two decades later, prison reformer John Howard noted that many of these devices were inadequate and made ventilation a central part of his crusade to improve prisons. His actions helped to shape the 1774 Act of Parliament for Preserving the Health of Prisoners, and prompted the Society for the Encouragement of Arts to fund a 17-year-long search for an improved method of ventilation by hand. I propose that the ongoing concern for ventilation was a central and oft-overlooked constituent of changing regimes of prison construction and prisoner reform that were emerging by the end of the eighteenth century.

Technology | Europe | 18th century |
Improvement, Ventilation, Prison reform

Discussing the Legitimacy of Astrology with Inquisitors: Non-Scholar Witnesses on Free Will and University Lectures in Seventeenth Century Trials

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Universitat de València

In their efforts to follow the instructions emanated from the Council of Trent, Sixtus Vth Bull *Coeli et Terrae*, and the rules established by the commissions of the Roman and the Spanish Indexes of Forbidden Books, Spanish Inquisitors involved in trials for the practice of astrology dealt with not only the reports of experts about the discipline, but also with the testimonies of people of all levels of literacy and social class origins. Previous studies have focused on the scholarly debates held by theologians, astronomers, mathematicians, physicians and natural philosophers on astrology and its practice (Pardo-Tomás 1991, Caro-Baroja 1992, Lanuza-Navarro 2017). The objective of this paper is to put the focus on non-scholar witnesses involved in trials related to the practice of astrology, with the aim of revealing their attitudes towards the discipline and their knowledge of the extent of the prohibitions, as well as the opinions

they expressed on crucial aspects of the debate such as free will. It aims to contribute to the study of the circulation of concepts related to the prohibition and persecution of astrology outside scholar circles, among wider audiences, and the strategies members of the popular classes used when confronted with the Inquisitors to present their own and others' cases.

Physical Sciences | Europe | 17th century |
Astrology, Spanish Inquisition, astronomy,
medicine, censorship, circulation of knowledge

Diversity and Biodiversity: Applying Oral History to Community, Ecology, and Archeology in America's Amazon

Kathy Cooke

University of South Alabama

The Mobile-Tensaw Delta, known as "America's Amazon," supports incredible biodiversity—including oaks, turtles, birds, and snakes, who fill the landscape that has been carved by glaciation, flowing rivers, flood basins, and tidal patterns. Archeology also demonstrates varied human habitation. Prehistoric mound cultures illustrate the lives of a hereditary elite. Woodland cultures populated areas now named Little Lizard Creek and Bottle Creek. When Europeans arrived, they joined, and sometimes enslaved,

native tribes such as Apalachees, Taensas, Chitimachas, and Alabamas (143). The landscape also bears marks of colonization by the British, African slavery, Civil War battles, and the American Black Freedom Struggle. In the spirit of "telling the stories of science," in this paper I draw on recent oral history interviews to connect contemporary scholarly understanding of the ecology and pre-history of this area with the popular understanding of its environment, ecology, and archaeology. I argue that landscape, biodiversity, and human diversity create unique ecological juxtapositions in this little-studied part of Alabama. I will rely on oral histories of self-proclaimed "Delta rats," such as Lucy "Pie" Hollings, Sylvester Crook, and Jimbo Meador, who embody Native American, African-American, Creole, and/or European heritage (151-154). These interviews study local ways of life—including turtle harvests and farming, tourism, rattlesnake round-ups, and wildlife festivals—and how these demonstrate and relate to contemporary scientific understanding of the area. Notes from A State of Knowledge of the Natural, Cultural, and Economic

Resources of the Greater Mobile-Tensaw River Area, Natural Resource Report NPS/NRSS/BRD/BRD/NRR--2016/1243.

Tools for Historians of Science | North America | Cultural and cross-cultural contexts, including colonialism in general | oral history, ecology, landscape, diversity, biodiversity, archeology, social sciences

Docteur Doyen's Photographic Anatomy Show: Objectivity, Showmanship, Difference, and the Reinvention of the Anatomical Image in Belle Époque France

Michael Sappol
Uppsala University

It's Paris, 18 April 1910. Eugène-Louis Doyen (1859-1916) takes the stage to deliver a lecture on topographical anatomy. Doyen intends to astonish the crowd with a *carnivale moderne* of medical science. There will be: lantern-slide projections of color photographs of machine-sliced cross-sections of "scientifically mummified" cadavers; silent films of surgeries; displays of actual cadaveric slices, via direct presentation and episcopic projection; even a bit of onstage dissection. As the program commences, Doyen's supporters and detractors come to blows. The lecture becomes a notorious fiasco,

reported on in the Parisian press and New York Times. It's an episode full of juicy details that bear on the politics and practice of elite French medicine, the staging and meaning of scientific lectures and photographic presentation, the performance of scientific persona, and the media milieu of *belle époque* France. Yet historians have somehow overlooked the riot, Doyen's photography, and the larger corpus of photographic anatomical image production from its 1860s origins through its development over many decades following. This paper focuses on the 279 photographic plates of Doyen's amazing, disturbing *Atlas d'anatomie topographique* (1911-12)—the unheralded masterpiece previewed onstage that April evening in Paris. I want to consider the meanings, aesthetics, dramaturgy and boundaries of Doyen's extremophile scientific and representational practice—*anatomical photography* as social, cultural, and professional performance. My questions: What difference did photography make to anatomy? And, if photographic construction of the universal anatomical human violated normative conventions of idealized anatomical representation, what

difference did photography make to the representation of difference?

Medicine and Health | Europe | 20th century, early | photography, anatomy, France, dissection, aesthetics, representation, medicine

Doing Theory: German-Speaking Research Communities in Theoretical Biology, 1901-1945

Jan Baedke

Ruhr University Bochum

This paper investigates different research traditions in early German-speaking theoretical biology. A century after the term ‘biology’ was coined, a number of scholars started to argue for the need to develop a ‘theoretical biology’. While through the works of, among others, Johannes Reinke and Jacob von Uexküll interests in biological theorizing grew steadily, the new field’s aims and research methods were quite diverse. Theoretical biology was argued to allow conceptual clarification, theoretical ordering, organization of research activities, better communication of results, abstracting from the ‘burden of details’, securing the autonomy of biology from physics, and ultimately, unifying biological research. Due to this heterogeneity still today large part of early theoretical biology remains poorly understood. By focusing on two of

the most central figures in this young discipline, Julius Schaxel and Adolf Meyer-Abich, this paper, first, seeks to disentangle and classify individual motivations of scholars to promote theorizing in biology. This includes clarifying theorists’ (i) different views on the relationship between theory and experimental practice in biology, (ii) underlying philosophical frameworks (e.g., holism, dialectical materialism), and (iii) terminological characterizations of the new field (e.g., ‘general biology’ vs. ‘theoretical biology’). Second, the paper provides an overview of the structure and conceptual debates of this large (and today largely forgotten) German-speaking theoretical research community until the end of WWII. Therefore, contributions to the two central book series of the time, Schaxel’s ‘Abhandlungen zur theoretischen Biologie’ and Meyer-Abich’s ‘Bios’ will be discussed.

Biology | Europe | 20th century, early | Theoretical Biology, Julius Schaxel, Adolf Meyer-Abich, ‘Abhandlungen zur theoretischen Biologie’, ‘Bios’

Don't Meddle in Physical Considerations of the Mind: Locke and the Problem of the Naturalization of the Mind

Charles Wolfe
Ghent University

How does Locke contribute to the development of projects for a science of the mind, even though he seems to reject or at least bracket off such projects himself? A canonical empiricist, Locke nevertheless goes out of his way to state that his project to investigate and articulate the 'logic of ideas' is not a scientific project: "I shall not at present meddle with the Physical consideration of the Mind" (Essay, I.i.2). Locke further specifies that his analysis of mental processes will not engage with knowledge of the brain (even though he had been the student of Thomas Willis). Now, Kant seemed to make an elementary mistake, given Locke's clear statement, when he claimed that Locke's project was a "physiology of the understanding" (KRV, Preface to A edition). If Locke's project was not a physiology of the understanding, what might this have been? Thus I examine, not the well-studied fortunes of Lockean thinking matter, but Locke's impact on scientific treatments of the mind,

including in the sense of a 'naturalization' of the mind. Because if Kant made this charge, many 18th-century thinkers in fact positively treated Locke as their great forerunner in psychological fields, Charles Bonnet and Joseph Priestley among them, just as some prominent physicians such as Cabanis claimed to be 'finishing the job' that Locke had started in, e.g. their materialist theories of the passions. The 'Locke Problem' here is: how can one reconcile empiricism and claims about cerebral processes, while seeking to remain a Lockean?

Medicine and Health | Europe | 18th century | John Locke; Physiology; History of Medicine; Materialism

Dry Subjects: The Collection of "Artificial" and "Natural" Mummies from Peru in the Nineteenth Century History of Science

Christopher Heaney
Penn State - University Park Campus

To preserve the dead requires a well-timed pause—a cultural and technological application of energy or chemicals to create an indefinite ellipsis between a being's biological expiration and the decay of their matter. In the eighteenth century, natural historians borrowed a word

from the Old World, ‘mummy,’ to describe ancient human specimens of that dead worldwide. These conditions are also environmentally occurring, which in some ‘extreme’ places allows the living to preserve the expired with so little effort that distinctions between living and dead subjects blur. Once such place is in South America, where peoples harnessed nitre-rich sands on the Pacific coast, and the western Andes’ cold, dry air, to preserve dead for millennia—a coupling remarked upon since the 1500s, when that place became ‘Peru.’ These conditions made the country a particularly globalized site of environmental and historical science and, when Peru’s Independence from Spain was declared in 1821, made its Inca or “ancient Peruvian” dead into highly collectible specimens, studied to distinguish between ‘artificial’ and ‘natural’ mummies. Yet when that dead travelled, they challenged epistemologies that insisted upon those distinctions. Removed from Peru’s culturally manipulated environment, the dead sometimes began to rot, requiring reproduction of ‘Peruvian’ environmental and cultural conditions to ensure preservation. In other words, if these

mummies weren’t ‘artificial’ or ‘Peruvian’ beforehand, collectors ensured that that was what they became. This paper therefore explores how the reproduction of place in the history of science extended supposedly peripheral cultures and geographies of science into the metropole.

Earth and Environmental Sciences | Latin America | 19th century | Peru, environment, archaeology, anthropology, museums, collecting, specimens, death, mummies

Early Modern Explanations of Habit and the Association of Ideas

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In his *Essay Concerning Human Understanding* John Locke gives two explanations of intellectual habits and the association of ideas, one a psychophysiological account that has its origins in the Cartesian science of the brain, and the other a purely psychological account that seems to be original with Locke himself. After laying out Locke’s two positions and showing how each fits into the larger project of the *Essay*, we trace them the first to Locke’s reading of Nicholas Malebranche’s *Recherche de la Vérité* and ultimately to Descartes’

Traité de l'homme. These models explain habit and association in terms of the flow of nervous fluids creating traces in the brain. The second explanation is based on the speed with which ideas pass through the mind after frequent repetition. Locke uses it to explain why we falsely believe that we "see" three dimensionality. This psychological explanation was taken up by George Berkeley in his *New Theory of Vision*, and by other 18th-century writers. However, the psychophysiological explanation also persisted throughout this period among both philosophers and medical writers including Hermann Boerhaave and Albrecht Haller. An alternate psychophysiological explanation briefly flourished based on the *Queries* at the end of Newton's *Optics*, and adopted by David Hartley in his *Observations on Man*. Nevertheless, it was the Cartesian brain-trace explanation which predominated throughout this period, and is even to be found at the end of the nineteenth-century in William James' discussion of habit and association in his *Principles of Psychology*.

Medicine and Health | Europe | 17th century |
John Locke; Association of Ideas; Habit;
Physiology

Early Modern Longevity and the Poetics of Extended Experience

Natalie Kaoukji

HPS, University of Cambridge

This paper examines the relationship between early modern accounts of longevity and the figuring of a new order of natural knowledge as a project of experience prodigiously extended, preserved and accumulated. Focusing on the English case, it examines the reinvention of longevity in the second half of the seventeenth century through reports of long-lived men in the *Philosophical Transactions*, discussions of the prodigious longevity of the Patriarchs, and natural historical surveys of the long lived. Treatments of longevity in such accounts have been commonly read as anticipating a factual, proto-demographic understanding of longevity. This paper instead proposes that seventeenth-century authors were interested not in the facts of longevity but in its figuring of the extended experience and immunity to decay exemplified by the media in which these discussions appeared. Projects of reporting, recovering, preserving and accumulating were not here passive vehicles for an approach to

knowledge that would reimagine the world as information, but the site of a concerted set of performances of the quasi-magical powers of such a condition.

Medicine and Health | Europe | 17th century

**Edward Lhwyd's 1699
Lithophylacii Britannicii
Ichnographia [British Figured
Stones]: Old and New
Classifications**

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The *Lithophylacii Britannicii ichnographia* [British figured stones] (1699) by Edward Lhwyd, the second keeper of the Ashmolean Museum, was the first illustrated field guide to English fossils. This paper analyses the book's physical creation—the collection of specimens, fieldwork sketches and their engravings—with an eye to understanding its use and reuse in eighteenth-century editions and collections that were in the transition to binomial taxonomy. Focusing on the *Lithophylacii*'s illustrations of fossils, this paper begins by examining how the specimens of crinoids, ichthyosaur teeth and vertebrae, sea urchin fossils, and 'piped waxen veins' or fossilized wood were collected in the field by

Lhwyd and hired searchers. We then examine the role of these specimens in subsequent editions of the book, demonstrating to what extent the relationship between them influenced collectors like Sir Hans Sloane and Daniel Solander from ca. 1680 to 1760. Finally, we will demonstrate how Ashmolean Keeper William Huddesford repurposed the illustrations in Lhwyd's book for his own eighteenth-century edition of the *Lithophylacii* (1760), incorporating new classificatory schemes. Our account provides insight into how a late seventeenth-century book of natural philosophy was used, revised, and repurposed by natural historians and collectors before and during the development of Linnaean taxonomy. We will concentrate upon the implications of migration of natural knowledge from one medium to another, from object to drawing to printed image, as well as its circulation and the establishing of credibility and taxonomic type characteristics in scientific (visual and textual) discourse and illustration.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 18th century

Egypt's TV Sexologists and the Politics of Modern Femininity

Soha Bayoumi
Harvard University

Since Foucault's *History of Sexuality*, sexology has been viewed by historians of science and medicine as a marker of sexual modernism, a category of biopower and an apparatus of discipline and social control. Postcolonial historians of medicine, including historians of the Middle East, have complicated our understanding of sexology as both an instrument of imperial control and a potential tool of social critique and resistance to colonial assumptions. More recently, feminist historians of medicine have highlighted the roles played by women sexologists as a way of countering the historical narrative that viewed women and their sexuality solely as objects of study and control by a male-dominated medical establishment. Modern interest in the scientific study of sexuality in the Middle East can be traced back to the mid-nineteenth century. This interest manifested in various ways during the colonial period and over the course of the twentieth century. Most recently, new media allowed for the proliferation of sex education TV

programs, websites, YouTube Channels and social media accounts. In this paper, I aim to contribute to the growing scholarship on sexology by examining the role played by contemporary women sexologists in Egypt and their role in cultivating ideals of modern, bourgeois feminine sexuality. Turning to two "popular" female sexologists and sex educators, Heba Kotb and Alyaa Gad, I aim to historically contextualize these popularized iterations of the scientific discourse on sexuality and how they approach questions of modern sexuality in relation to other discourses, such as religious and moral discourses.

Medicine and Health | Near and Middle East | 21st century | sexology, postcolonial history of medicine, modern femininity

Eighteen Years in the Paraná: Explorations of Latin American Nature by Diego de Alvear y Ponce de Leon

Matthew Franco
College of William and Mary

Following the Treaty of Madrid (1750) a bilateral Boundary Demarcation Commission was established to negotiate a permanent Luso-Hispanic Boundary in Ibero-America. The division between Spanish and Portuguese America remained imprecise, metaphorically

drawn through a wild hinterland characterized by impenetrability and seclusion. Owing to the lack of scientific observations, the Commission dispatched parties of geographers to survey the limits and study its environmental conditions. The career of one Spanish agent, Diego de Alvear y Ponce de Leon (1749-1830), illustrates the prolonged process of boundary demarcation and the extensive observations and measurements it produced. Although colonial agents and Jesuit priests traveled through Amazonia and the upper Paraná beginning in the sixteenth century, the indigenous populations and natural resources of these regions remained largely understudied. Simply put: what lay hidden within the imposing environment? Surveying efforts began in 1751 and stretched as late as 1801 in remote regions. The scope of the project strained imperial resources, but it also produced unprecedented European observations of some of the most remote environments in Ibero-America. Alvear's eighteen-year survey of the Paraná and Paraguay river basins included cartographic surveys, natural historical writings, and proto-ethnographic reports. Drawing on

Alvear's diary from the survey and his published account of the region, this paper will examine Spanish conceptions of the Paraná as an extreme environment through the lens of environmental, political, and social history.

Earth and Environmental Sciences | Latin America | 18th century | colonial, exploration, geography, boundary commission, environment, survey, Paraguay

Elephant Empire beyond the Colonial Frontier

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Animal trade constitutes one of the key factors of animal mobility beyond their natural habitats. Exotic specimens found their way to menageries and zoos following the routes of colonial conquest and possession of land and natural resources. Whereas zoological gardens and animal collections in North America and Western Europe are well researched, surprisingly little attention has been paid to the history and legacy of these modernizing institutions in Eastern Europe. In this presentation, I investigate the traffic in exotic animals to this region with a focus on a particular species. Historically, elephants have been considered

prime symbols of power and triumph of the colonial empire, and thus were often the jewels of colonial animal collections across Europe (Ritvo 1987). I explore how the colonial origin of elephants as both big game (being hunted for ivory, taxidermy, meat) and charismatic megafauna (spectacular mammals on display) translates into a geopolitical context without direct overseas colonies, in order to trace the material links between species, race, transnational commodity networks, and structures of identity formation. From this vantage point I suggest that studying public zoos in Eastern Europe offers a unique insight into a physical presence of colonial imperialism (via traffic in exotic species) in an area without overseas colonies, through a site where modernist models of citizenship, nationhood, and Europeanness are forged at the interface between science, education, and transnational politics.

Thematic Approaches to the Study of Science | Europe | Cultural and cross-cultural contexts, including colonialism in general | animals, zoological gardens, colonial animal collection, exotic species

Ellsworth Huntington, Punch Cards, and Climate and Mortality Research in the Early 1920s

Samuel Randalls
University College London

The early 20th-century American geographer Ellsworth Huntington is well-known for his work on climatic determinism, eugenics and in writing popular geographical textbooks (Fleming, 1998). Huntington's work sought causal explanation for the patterns of civilization and mortality across the globe, in particular focusing on climatic, cultural and hereditary factors. His compilations of vast swathes of data were often crude and led to generalised claims that were subsequently widely critiqued. In research on climate and mortality in New York City, however, Huntington worked with prominent experts in American life assurance and with their latest technologies (namely punch cards, sorting machines and tabulators), to analyse late 19th century data and propose causation between particular climatic conditions and death rates. Indeed, this work was pioneering in its use of such equipment at that time and in the working relationship developed between insurers and climatologists. These technologies,

however, also shaped this work in at least three ways: through the limiting cost of the equipment and labour, the style and structure of the standard Hollerith punch card, and the typical practices of clerks in the life assurance companies. Drawing on archival fieldwork at Yale University with the extensive early 1920s correspondence between Huntington and notables like Arthur Hunter (actuary, New York Life) and Louis Dublin (statistician, Metropolitan Life), the paper contributes to discussions of materiality in the history of the atmospheric sciences. Through narrating this example, the paper re-asserts the importance of understanding how climatological research is produced through the socio-materialities of technological and institutional systems.

Earth and Environmental Sciences | North America | 20th century, early | Climate and mortality, life assurance, climatology, computing, punch cards

Embedding New Theory in Brass: Alfonsine Trepidation Spheres

Samuel Gessner
CNRS SYRTE UMR 8630

The slow changing position of the fixed stars with respect to the vernal point, directly observable through the stars' changing orbitive amplitude,

were accounted for by diverging models during the Middle Ages. Ptolemy assumed a linear increase of stellar longitude over time. A text on the movement of the Eighth Sphere (the sphere of the fixed stars), sometimes attributed to Thābit ibn Qurra, circulated in the West and described a back-and-forth movement. In the Latin world this movement of “access and recess” was termed trepidation. The Toledan tables (11th c.) included this same movement of trepidation. In the Castilian Alfonsine tables (ca. 1270) trepidation of the Eighth Sphere is also considered. In Parisian Alfonsine astronomy those secular changes are described by combining a linear change (one revolution in 49000 years) with a trepidation movement. Very few spatial, material representations of these aspects of astronomical theories are known: today only about a dozen surviving armillary spheres are modelling the phenomenon of trepidation. Some such trepidation spheres from the 16th century are signed by the famous G. Arsenius. A systematic description and comparison of these spheres is still lacking. An outline of such a comparative study will here be proposed. It will have to tackle the

relationship between competing theories, astronomical tables and canons on the one hand and visual representations, including diagrams and material models, like armillary spheres, on the other.

Physical Sciences | Europe | Medieval

Emblems as Magic Tools and Heuristic Devices: Bruno, Bacon, and Culianu

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This paper proposes a comparative investigation of the use of emblems in two leading vitalist natural philosophies of the Renaissance, Giordano Bruno and Francis Bacon. Bruno and Bacon are rarely treated together. And yet, they share a lot: an “operative” vision of scientia, an appetitive matter-theory, a belief in the powers of imagination. Both see the natural philosopher as a manipulator of the material appetites engaged in a “renovation” of knowledge and power. Further, more precise similarities are not immediately apparent, mostly because of our own historiographic assumptions. My proposal in this paper is to rely on Ioan Petru Culianu’s more flexible historiographic framework in order

to provide a broader and more comprehensive context for my comparison. Culianu sees magic as a very general, “phantasmatic process” operating upon desires and appetites of matter. Since the human mind cannot operate without phantasms, magic is everywhere – intersubjective, intrasubjective and not always crossing the threshold of human awareness. Culianu’s “sciences of the Renaissance” can be interpreted as various attempts to control, operationalize and understand this process. Within this framework, my scope is to analyze Bruno and Bacon’s use of emblems – codified procedures intended to fix the meaning of phantasms – in order to unearth further similarities between their respective attempts to understand and exploit various “phantasmatic manipulations.” I show how for Bacon and Bruno – and, perhaps not surprisingly, for Culianu as well – emblems have not only mnemonic, but also heuristic functions, while also serving as “magic tools” to create patterns and “binds” for the imagination.

Physical Sciences | Europe | 17th century

Enacting Race While Objectifying Race: Recovering the Story of the Dutch New Guinea Expeditions (1903, 1909) for the History of Anthropometry

Geertje Mak

University of Amsterdam

The scientific idea(s) of racial anthropometry—as formulated by one of the most influential scientists of that field, Rudolf Martin, and taken over by his Dutch pupil Van der Sande—entailed a strict objectification of the study of anatomical difference in relation to geographical descent. It was, in the terms of Daston and Galison, a science driven by an epistemic ideal of objectivity through ‘selfless’ science, in which ‘first impressions’ or non-standardized measures and observations were anathema. Thus, when presenting the anthropometric data from his 1903 expedition to Dutch New Guinea, Van der Sande sought to completely disentangle his data from the story of the expedition. The data was presented as ‘pure facts’, ready for circulation in European ‘centers of calculation’. To un-tell this kind of scientific reporting, in this paper I will retrace the practicalities of the expedition. This will show how, in paradoxical contrast to an ideal of measuring

race independent from subjective impressions, the expedition itself continuously enacted race in the way it assigned roles and practically divided groups within the expeditionary group. This contradiction short-circuited when the successor of Van der Sande in the third expedition, Von Römer, started to measure the non-European members of the expedition team.

Thematic Approaches to the Study of Science | Southeast Asia | 20th century, early | anthropometry, race, Dutch New Guinea, scientific practices

Encounters in Africa: When Livingstone Met Welwitsch

Angela Salgueiro

ANGELA SALGUEIRO

From 1851 onwards, coinciding with a period of relative political stability, Portugal achieved the necessary conditions for the development of its imperial plan. The Portuguese Government believed in the wealth of its African possessions, despite several public discussions about the future of the territories in the 1860s. The expedition *Iter Angolense* (1853–1860), led by Friedrich Martin Joseph Welwitsch (1806–1872) an Austrian doctor and botanist, occurred at a time when the imperial plan became established. Welwitsch was sent by the

Portuguese Crown to what is known today as Angola. The objective was to collect data, plants, animals, and minerals for scientific analysis and to ascertain their economic potential. On 3 September 1859, Welwitsch was the first European to describe the famous Namib Desert plant, later named *Welwitschia mirabilis* in his honour. During this expedition, the botanist met David Livingstone (1813–1873), the famous explorer, doctor, geographer and missionary. Although the fact Welwitsch and Livingstone met while they were in Angola is recognized, this encounter has hitherto been studied in depth. These famous explorers met at Golungo Alto in 1854, and this encounter would affect both of them in different ways. This work in progress intends to explore the networks of knowledge and the impact of this encounter in a period that preceded the formation of the Society of Geography, Lisbon (1875) and the Scramble for Africa.

Aspects of Scientific Practice/Organization | Africa | 19th century | Natural History Collections, Scientific Expeditions in Africa, Science and Colonialism, Museum Studies, Science in the Portuguese Empire

Enlightenment's Apocalypse: Providence, Prophecy, and Science in the Work of Joseph Priestley

John Christie

John Christie, University of Oxford

Joseph Priestley had a particular story to tell about his own and others' scientific work, or rather a larger story, religious in nature, which historically placed and specified the fundamental meanings of historically recent and contemporary natural science. This paper will reconstruct these meanings firstly by analysis of his preoccupations with the nature and forms of divine providence, and his concern to detect God's 'different footsteps', the traces of divine action in human history. This analysis produces a concept of Priestley's 'providential epistemics' as the basis of his perception and grasp of historical meaning, and aspects of the natural sciences are among his most significant exemplars. The paper then focuses upon his his hermeneutics of Biblical prophecy, emphasizing its intensely apocalyptic tenor, its presentist interpretation of prophecy, its latter interest in the restoration of the Jews to the land of Canaan and their conversion, and its stress upon the

recent course of science as herald of apocalyptic imminence. Priestley's understanding of the historical meanings of the progress of natural science recall that of the Puritan millenarians of the mid- seventeenth century English Revolution. For historians of the eighteenth century, particularly historians of Enlightenment, to which historiography Priestley and his radical Dissenting colleagues are often assimilated, unavoidable problems occur once the apocalyptic disposition of Priestley and his colleagues is taken as a characteristic and forceful feature of their work. The paper thus concludes with consideration of the issues raised for Enlightenment historiography by recognition of Priestley's apocalyptic discourse.

Thematic Approaches to the Study of Science | Europe | 18th century | Enlightenment, science, religion, apocalypse, millennium, providence, prophecy, historiography.

Environmental Science for National Development: The Seoul Environmental Assessment Project of the Smithsonian Institution, 1971-1975

Chuyoung Won

Seoul National University (SNU)

This paper explores the US-Korea collaborative environmental assessment of Seoul, South Korea, in 1971-1975. With increasing global-scale pollution during the Cold War, environmental scientists and government officials of the U.S. recognized value of collecting environmental data. In this context, the U.S. Agency for International Development (USAID) established a plan to make guidelines for the environmental policy in developing countries in the late 1960s. As a part of this plan, the USAID implemented an environmental assessment project of Seoul through a contract with the Office of International and Environmental Programs (OIEP) of the Smithsonian Institution. The goal of the guideline plan was to collect data and to reduce the environmentally detrimental impact on cities in developing countries. Seoul, the capital of South Korea, was an ideal place for USAID officials because

as a result of urban growth and population increase the city had gone through the most severe environmental pollution among cities in the developing world.

Although Korean Scientists were eager to engage in the collaborative project as it funded their research, the authorities of Seoul feared the project's possible conclusion that would harm the nation's reputation. This paper analyzes how science on environmental data collection was made compatible with the national economic development of Korea by examining the relationship and tensions among OIEP, Korean Scientists, and governmental officials of Seoul. This paper illuminates that the Seoul project was essential to the construction of the idea of a “sustainable development” for developing countries.

Earth and Environmental Sciences | East Asia | 20th century, late | History of Environmental Science, Environmental History, Environmental Assessment, Urban Planning

Epistemic Configurations: Experience in the Medieval Sciences of Soul and Body

Katja Krause

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What were the epistemic configurations of experience in the medieval sciences of soul and body? Simple sense perception, *inspectio*, *anathomia*, *iudicatio* by common sense, pre-universal *experientia*, and expertise all occupied distinctive, yet decidedly standardized spaces in the cognitive realm of the sapiens. For Peter of Spain (ca. 1215-1277), the science of animal souls and bodies required sense perception and judgment in acquiring knowledge, particularly of its most specific species. For Albert the Great (1200-1280), simple sense perceptions had the epistemic power to verify or falsify theoretical facts in the sciences of soul and body, but they first had to pass the common-sense judgment of the expert. All this shows that scientific experiences were principally shared by the sapientes; they were, so to speak, universal and individual at once. The purpose of this paper is to shed some light on these pragmatics of experience, both by exposing the mental realm as the integral

backbone to the practices, standards, and conceptualizations of experience, and by illustrating how the ideals of this realm became embodied in the practices of the medieval life sciences developed by historical actors such as Peter of Spain and Albert the Great.

Theoretical Approaches to the Study of Science
| Europe | Medieval | Experience, philosophy,
cognition, medieval, theology, mind

Erle Stanley Gardner's "Court of Last Resort" and the Pursuit of Wrongful Conviction in Cold War America

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Since the first US case of post-conviction DNA exoneration in 1989, national advocacy organizations, spearheaded by the Innocence Project, have championed the cause of potentially innocent prisoners, raised public awareness, and promoted policy reform. These developments have been hailed as the dawn of a uniquely modern moral, legal and scientific order – an ‘innocence revolution.’ In this presentation I question this claim to historical singularity by exploring a prior forensic framework of innocence centered on Erle Stanley Gardner's ‘Court of Last Resort.’ Today Gardner is remembered as the

creator of Perry Mason, the intrepid attorney who successfully cleared underdogs caught ensnared in false criminal charges. In the late 1940s Gardner sought to replicate Mason's fictional heroics by establishing his ‘Court’ as an expert board dedicated to investigating cases of wrongful conviction. In many respects, Gardner's enterprise shares some essential structural features of our present innocence moment. Yet as I will argue Gardner's project was profoundly influenced by the political, legal, cultural and scientific context of Cold War America, and this determined both the forensic techniques it deployed in the pursuit of innocence, and the criteria for selecting whose claim to innocence was worth pursuing.

Thematic Approaches to the Study of Science |
North America | 20th century, late | Forensic
Science, Cold War Science, Popular Science,
American Science

Exotic Plants in the Crisis of the Galenic System and the Eighteenth-Century Medical Debate

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In early modern times, a considerable increase in the knowledge of the exotic medicinal

plants enriched the European pharmacopoeia. The introduction and presence of new medicinal botanical species coming from the East and the Americas is testified by their inclusion in the various treatises of medicine, natural history and systematic botany, in the pharmacopoeias, in the apothecary's shops, and in the European botanical gardens of that period. During the entire sixteenth-century, under the influence of Galen's theories, a difficult attempt was made to fit these new plants into the pre-existing taxonomy. The Galenic system, which had accommodated both the therapeutic use of the plants whose efficacy had been proved and the mechanical explanation of living bodies, during this century began to be affected by a progressive separation between the two hypotheses. On the one hand, the increasingly substantial natural history treatises that introduced unknown botanical species and, on the other hand, the mechanistic explanations of nature, all became the object of medical studies in the seventeenth and eighteenth-century. The claim that only by experimenting on the bodies of cavies could it be possible to attain the knowledge of the operation of

living organisms was agreed upon by most physicians. The effort to find new remedies for old epidemic diseases gave rise to a growing interest in research, in the use of exotic plants, and in the verification of their therapeutic powers.

Thematic Approaches to the Study of Science | Global or Multilocational | 18th century | East and West Indies, global botany, therapeutics, medicine

Experience, Discovery, and Utility: Roger Bacon in the Age of Francis

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This paper examines the importance of experiential knowledge in the work of thirteenth century natural philosopher, courtier, and Franciscan friar Roger Bacon (ca. 1214-1292), who saw experience as central to understanding natural knowledge, and to converting that knowledge into useful tools and processes to improve human life and exert power. Furthermore, this paper demonstrates how Bacon's views on the necessity of experiential knowledge to confirm and discover the laws of nature dramatically shaped the contours of his reception in the sixteenth and seventeenth centuries, as well as early modern ideas about utility and experiment.

Experiential knowledge is the common thread that runs through the many stories about Bacon that appeared in Latin and in English, on the stage and in historical annals in the early modern period. Whether a figure of sorcery or as a committed experimenter undone by the Church, legends and accounts of Bacon that appeared in the centuries after his death portray him as one interested in learning by doing, and in using natural knowledge in the service of political utility. Bacon's treatises appeared in the libraries of men like John Dee and Francis Bacon, who found in Bacon's work an interest in utility, discovery, and experiment that matched their own. Bacon's interests in experience and experiment, in the service of utility and epistemic gain, are vital to understanding the intellectual transformation often called the Scientific Revolution and reveal important intellectual continuities between the medieval and the early modern periods.

Thematic Approaches to the Study of Science | Europe | Longue Durée | Experience, experiment, medieval, Roger Bacon, Francis Bacon, Scientific Revolution, philosophy, scientist

Experimental Abstraction: Francis Galton, John Venn, and Cambridge Anthropometry, 1887-1891

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The story of statistics before 1900 is one of a logic common to every science that emerged from the interplay of two developments: the combination of observations and the use of probability mathematics. Both having separate beginnings, these two developments intersected in the first decades of the 19th century, only to spread as a single method horizontally – across scientific disciplines – and vertically – in terms of technical sophistication. This neat story comes at the prize of a loss of historical accuracy. The main reason is its focus on abstract concepts and lack of attention to the material and local aspects of the interplay between observations and mathematics needed to establish sufficiently abstract statistical knowledge. The present paper draws on original archival research to describe a remarkable, yet hitherto little-known episode in the history of statistics: Francis Galton's collaboration with John Venn, between 1887 and 1889, in an unofficial psychometrical laboratory

at Cambridge. Its focus is on the various difficulties Galton and Venn in their joint endeavor, which ranged from choosing a suitable room and weighing the reliability of instruments to aligning statistical techniques with measurement results. In doing so, Galton and Venn were forced to use their polymathic skills to come up with hands-on ways to find out what were relevant statistical associations. The paper concludes by placing the Galton-Venn laboratory into the context of the emergence of psychology at Cambridge and by considering its importance for the discipline of statistics in the 1880s-1890s.

Thematic Approaches to the Study of Science | Europe | 19th century | Francis Galton, John Venn, history of statistics, history of psychology, abstraction

Exploring New "Histories of Nature" with Marine Microbes: Living Matter at the Edge of Life

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University of Exeter

In the face of the current environmental crisis, i.e. climate change, the life and death of marine microbes has gained renewed scientific attention. Until recently unicellular marine microbes, such as phytoplankton, have been

considered immortal unless eaten by predators. As marine ecologists recognize phytoplankton's important role in the global carbon cycle, the assumption of their atemporal existence is currently revised. Microbiologists suggest that under specific conditions entire populations of phytoplankton actively kill themselves. Drawing on empirical research into the life and death of marine microbes, this paper explores how an affirmation of phytoplankton's mortality may reconstruct the relationship between life and death and how deep seated metaphysical assumptions may become revised in a time of crisis. The idea that death is an evolutionary adaptation seems no longer tenable. As phytoplankton challenge the relationship between life and death and the boundary between an individual and a population, marine viruses are complicating the boundary between life and nonlife and the ontologies of substance and process. The liveliness of viruses seems to depend on their connections. Together, I argue, recent research into marine microbes suggests new histories of nature in the ocean, while also

interrogating the relationship
between science and philosophy.

Tools for Historians of Science | Europe | 21st
century | Phytoplankton, Climate Change,
Ecology, Death, Metaphysics

Facing the Past: Ancient Skulls and National Identity in the Middle East

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University of Cambridge

In the nineteenth and early twentieth centuries, the cranial or cephalic index was a widely used calculation for racial classification. This particular measurement, which could be applied both to skulls and to the heads of living people, allowed the comparison of members of ancient and biblical civilizations to modern inhabitants of the same territories. Human remains excavated from archaeological sites across the Middle East prompted transregional interest in racial origins: who were the closest living descendants of (and therefore legitimate political-cultural heirs to) the Phoenicians, Indo-Aryans, and other celebrated pre-Islamic civilizations? Here, I analyze anthropometric studies in Lebanon and Iran in the first half of the twentieth century, showing how this preoccupation with ancient origins collided with intersectional and contested meanings of race and

nation. In both countries, nationalist intellectuals and politicians used the cephalic index as a scientific tool, both to bolster the international legitimacy of their sovereignty claims and to promote particular narratives of national history. In Lebanon, anatomists and archaeologists argued over the racial classification of different Christian and Muslim sects as part of a highly politicized debate about Phoenician versus Arab ancestry. Meanwhile, Iranian scholars exhumed the remains of national heroes like Avicenna, measuring their skulls to prove their “Aryan” racial identity and reconstruct their physiognomy for sculptural monuments and portraits. Phoenicianism and Aryanism remain powerful racial-national discourses in contemporary Lebanon and Iran, where they continue to shape scientific interpretations of recent ancient DNA studies and forensic facial reconstructions of human remains.

Biology | Near and Middle East | 20th century,
early | Craniometry, Nationalism,
Anthropometry, Race, Archaeology

Fact-Checking Herodotus across the Disciplines

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Louisiana State University

One of the most pressing questions for the historically-minded nineteenth century was this: just how much could one trust Herodotus? Known since antiquity as ‘the father of history,’ Herodotus was also notorious for reporting improbable marvels (immense man-made lakes) and sensational tall tales (Arion the bard saved from drowning by a dolphin). Already in the later eighteenth century, scholars began following in the footsteps of the widely-traveled Greek, measuring the Hellespont, investigating wind patterns on the Nile, following crocodiles to check Herodotus’ accounts. The process involved scholars of all types—military geographers, zoologists, proto-ethnographers, archaeologists, orientalists—and a great deal of controversy about how to translate ancient measurements, how to ‘read through’ Herodotus’ Greek to establish proper Egyptian or Persian terms or names, how seriously to take his account of the flying snakes of Egypt, how much change in ‘oriental’ habits to expect over time. In each case, scholars had to decide

what it would mean to verify a report given by Herodotus, and debate led to new cycles of research, and more, often highly creative, strategies of verification (or falsification). In this paper, I will offer a few examples of the ways in which scholars with different backgrounds tried to fact-check Herodotus. I will underscore the difficulties all sides faced in making arguments that stuck, but also the gradual emergence of a consensus across the disciplines that Herodotus, in many cases, was a worthy companion, if hardly an inerrant patriarch.

Tools for Historians of Science | Europe | 19th century

False Images Do Not Lie: Using Anatomy in Rene Descartes' Treatise on Man

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Claremont Graduate University

Illustrations and paper technologies contributed to and enhanced early modern science and especially the study of anatomy during the sixteenth century, not least by providing more accurate representations of the human body and allowing for the dissemination of consistent images. This paper documents a moment in the use of

anatomical illustration involving disputes over Rene Descartes' posthumously published *Treatise on Man* (1662/1664), a work with its own convoluted history and reception, involving multiple copies of the original manuscript and three sets of illustrations made by three different physicians: one set for the Latin edition and two others for the French edition. Focusing on these illustrations, this paper will argue that they primarily model how the visible movements of the body might be caused, with little attention to accurately describing the parts of the body as seen in dissection. In the medical terminology of the period, they narrowly focus on *actio*--action or *functio*--and were conceived as an answer to the question of how the hidden parts of the body operate. In this way, they provide an alternative to traditional anatomical illustrations focused on *historia* and how the body is actually structured. Thus the *Treatise* is an especially interesting work for its history, for the disputes and rationale that led to its famous images, their reproduction both in later published works and in students' notebooks throughout Europe, and for the demarcated yet productive role given to anatomical

illustrations apart from an accurate description of the human body.

Thematic Approaches to the Study of Science | Europe | 17th century | Descartes, anatomy, anatomical illustration, editorship, biological function, Cartesianism

Female Authority in Translation: Medieval Catalan Texts on Women's Health

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University of Cantabria, Spain

My paper intends to explore the impact of translation practices on the construction of female authority in one particular vernacular tradition. My approach traces how late medieval Catalan medicine articulated its own notion of female medical authority by acknowledging, adapting and erasing Latin ideas while translators, adaptors and compilers were working to bring medical literature over to new audiences. It intends to analyze through a focused case-study the gendered effects of a broad cultural process of mediation that has not been explored from this perspective. The Catalan corpus of medical texts is a relevant instance as it belongs to a particularly rich and geographically widespread linguistic tradition in the late middle ages. With the determined political concourse of the Aragonese crown,

Catalan became a medical language from the late thirteenth century on, and the ongoing project *Scientia.cat* provides a detailed body of evidence for both extant and missing texts allowing for a solid reconstruction of the healthcare corpus. A significant number of texts were produced during the 14th and 15th centuries and extant translations date from as early as 1305, when laywomen and men as well as emerging new groups of healthcare practitioners were involved in commissioning, producing and consuming translations in the vernacular. This essay explores globally 14th and 15th century Catalan medical texts, but it considers especially a mid-fifteenth century translation of the *De curis mulierum* that I have recently identified in an anonymous surgeon's handbook.

Medicine and Health | Europe | Medieval

Firm Content, Fluid Forms: Al-Farghānī's Elements of Astronomy as a Recasting of Ptolemaic Astronomy

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In the 9th century, al-Farghānī composed a work on the elements of

astronomy which remained well-known for centuries during the medieval period. Through thirty chapters, he presented Ptolemaic astronomy in a way whose "rearrangement" and "rewording" was praised by medieval readers. Not bearing a particular title, this book spread the popularity of Ptolemy's ideas by being referred to as a "compendium" and a "summary" of the *Almagest* in its later reception. In excluding diagrams, tables and mathematical calculations, al-Farghānī delivers a descriptive exposition of Ptolemaic astronomy which claims to be "adequate" and "concise". The main goal of this paper is to explain the structure of al-Farghānī's exposition and the overall format of the book. In my explanation, I will provide a textual analysis which situates al-Farghānī's book in broader trends of medieval Islamic astronomical writing. I also consider the audience of his book, which focuses a pedagogical lens on the *Elements of Astronomy*. Through this analysis, I explore the interaction between the text, script and context of scholarly

writing in the Islamic world in the 9th century.

Physical Sciences | Near and Middle East | Medieval | Islamic, astronomy, medieval, pedagogy, Islamicate, Farghani, Ptolemy

Flayed: The Écorché Body in Eighteenth-Century Art and Anatomy

Marieke Hendriksen

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Images of flayed human bodies, so-called écorché figures, occur with some frequency in artistic and anatomical handbooks from the sixteenth century onwards. Three-dimensional écorché models ('anatomies') sculpted in wood or wax are also occasionally listed in artist's and collector's inventories from this period. However, écorchés cast in metal or plaster did not become a staple in the artist's workshop and the anatomy classroom until the eighteenth century. How did eighteenth-century artisans of the body, both visual artists and anatomists, collaborate in the creation of these écorché models? Why did one model in particular, jointly created by a Scottish anatomist and a Danish artist, become so popular and was reproduced so often that it became the écorché model? This paper seeks

to answer these questions and explores how the living and dead bodies involved in creating these objects – those of artists, anatomists, and their involuntary human models – interacted in complex ways and were valued very differently in the production process. The author argues that the introduction of serially produced, small écorché models in metal and plaster rather than wood or wax in the eighteenth century reflects a significant shift in the way three-dimensional models of the human body were created and used in both the production and the transmission of anatomical knowledge.

Medicine and Health | Europe | 18th century | Anatomy, art and craft, material history of science, anatomical models

Fluid Cosmologies, Pneumatics, and Atmospheric Studies in the Early Eighteenth Century

Victor Boantza

University of Minnesota

Boyle's mechanistic interpretations of fire and the 'spring of air' are relatively well known. The elusive link between these two branches of his science—in particular his sustained and original work on the nature of fluidity—remains understudied, partly due to Newton's long shadow in the history

of fluid mechanics. This paper explores some early eighteenth-century ramifications of these subjects, epitomized by Roger Cotes's 1708 comment that "hydrostaticks and pneumaticks have in nature so near a relation to each other, that they ought never to be separated." Building on Boyle and Newton, the first half of the eighteenth century saw the rise of what I call 'fluid cosmologies'—broad explanatory frameworks constrained by experimental results—combining themes and methods we associate today with geophysics, meteorology, chemistry, and physiology. Two prominent examples appeared in 1727, in Herman Boerhaave's *New Method of Chemistry*, which included a famous treatise on fire (one of his four elements-instruments), and Stephen Hales's *Vegetable Staticks*, best known for its new analysis of air. Situated in the context of fluid cosmologies, we see how old elements were still employed while being reimagined as universal agents of change. They straddled and marked new natural boundaries and entities, like activity vs. fixity and solution vs. cohesion; the subterranean, terrestrial, and atmospheric spheres; and material

vs. immaterial bodies and environments. More generally, we gain insights into the relations between natural philosophy and natural history as well as pneumatic matter theory after Newton but before Joseph Black and Antoine Lavoisier.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 18th century

Flying Caps and Throat Microphones: Solving the Problems of Aviation Communication in World War One

Elizabeth Bruton
Science MUuseum Group

Large-scale conflicts have long generated new practices and technologies of communication. As we have argued elsewhere (Bruton & Gooday 2016), long-distance aural communications became especially important in the First World War. In this paper we explore the new challenges of sky-borne telecommunication in that conflict as parallel innovations in aircraft and wireless (radio) brought opportunities for near real-time intelligence. Airborne wireless sets using Morse code existed prior to the war's outbreak in 1914 and voice-over-wireless systems were developed for airborne use by

former Marconi Company engineers working for the British Royal Flying Corps (RFC) in 1915. Yet the conjunction of enormously noisy engines and open cockpits in First World War aeroplanes initially created great difficulties for pilots to hear Morse code and even (later) voice messages. Even with noise-reducing adaptations of aircraft engines nearly a quarter of airmen suffered the additional problem of permanent hearing loss. Both problems were solved in the development of pilot's flying caps equipped with sound-resistant headphones around 1917. Combined with the new throat microphone, this system was successfully adopted by pilots into the Second World War and beyond.

Technology | Europe | 20th century, early | warfare, telecommunications, sound, hearing, military, states, technology, aircraft

From Analog to Digital: What Happens When a Historic Film Archive is Stored Electronically?

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Recently, several projects have been dedicated to transferring film collections into the digital world and hence, some significant online-

databases such as Europeana.eu have been created. However, it has hardly been examined from an epistemological point of view what problems and questions evolve when trying to (re-)contextualize film collections in online-databases and what happens to all the data connected to the films. Based on the history of institute for the scientific film (IWF) I will show some of the questions, problems and needs of a film archive being digitized.

Founded in 1956 as a successor of the Reich Institute for Film and Images in Science and the Classroom (RWU), the IWF provided a broad range of films dedicated for the use of researchers and scholars. One of the most significant collections was the Encyclopaedia Cinematographica (EC) which was seen to be the leading part of a world archive for all dynamic processes: humans, animals, plants and machines alike. Leading ethologists and biologists like Konrad Lorenz and Otto Koenig were involved in the institute's film projects. With the headquarter in Göttingen (Germany), the IWF sought to expand into a world wide network of scientific films. After the institute closed its doors forever in 2010, questions of digitalization and

long-term-archiving of the films became relevant and are even more so discussed today. This contribution to the panel connects the spheres of media history and the history of science and asks for the specific role of film as historic and material source.

Tools for Historians of Science | Europe | 20th century, late | science and media history, media archeology, history of digitization, audiovisual heritage

From Entomological Research to Culturing Tissues: An Attempt to Retrace Aron Moscona's Investigative Pathway

Alessandra Passariello

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Contemporary models of development are the result of the encounter of different research traditions such as molecular genetics, cell biology and tissue and organ culture. While molecular genetics was a privileged focus of historical analysis, research in tissue and organ architecture did not experience the same pick of attention. The paper aims at exploring this sideline tradition in the history of developmental biology through a reconstruction of the itinerary of the developmental

biologist Aron Moscona, pioneer in tissue and organ culture research. Moscona's models of the role of cell adhesion in tissue and organ development are the result of an eclectic career spanning between diverse areas of zoology: between 1946-1950, Moscona pursued entomological research, dealing with developmental changes in the chemical composition of eggs of *Bacillus libanicus*. During his PhD, he made use of anatomical and histochemical methods in order to detect changes in the pancreatic cells of snakes and lizards during the reproductive cycle. Then, from the beginning of the 1950s, he analyzed histogenetic and organogenetic processes in the chick embryo through tissue and organ culture techniques. Moscona's interest for development had an early start although the model organisms and the experimental techniques he made use of gradually changed throughout his career, bringing about or reflecting a visible change in the developmental questions he addressed. The paper records the evolution of Moscona's scientific thought by providing a composite narrative where experimental practice, disciplinary training and cross-disciplinary influences

orchestrate together to make accessible the scientist's "investigative pathway".

Biology | Global or Multilocational | 20th century, late | Aron Moscona, History of Tissue and Organ Culture, Developmental Biology, Cell to cell adhesion, Histogenesis

From Green to Blue: Ocean Conservation and Earth System Sciences

Lino Camprubí

Environmental activists and environmental historians were not particularly concerned with the oceans until recent times. While transformation (and degradation) in land was clearly visible, it seemed that the ocean well could take all kinds of poison without great distress. While there was a long tradition of conservation for fisheries and marine mammals that attracted the attention of organizations like Greenpeace in the 1970s, the ecosystems approach to conservation like that developed by Max Nicholson at the International Union for the Protection of Nature and the International Biology Program largely took the world ocean for granted. The Apollo pictures of the earth from above that accompanied the rise of global conservation efforts depicted a Blue Marble, and yet environmentalism

remained green. This paper documents the move from Green to Blue in two separate but interconnected realms: the local and the global. The first is provided by the efforts for understanding and halting marine degradation in the Mediterranean through the 1975 Mediterranean Action Plan (and part of the United Nations Environmental Programme). The second is illustrated by the rise of Earth System Sciences in the 1980s (with Lovelock's Gaia and the NASA) and the increasing importance granted to the world ocean, for instance as a climate regulator. Simultaneously, oceanographers were now looking at ocean circulation as subject to cycles and sudden changes. The conveyor belt, a new theoretical entity, needed not only to be described but also monitored. Although oceanography, geochemistry and atmospheric sciences were key in this shift to blue, looking at their different approaches and scales sheds light on processes of integration and disintegration in global conservation.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, late | Conservation, environmental science, transnationalism, localism

From Place to Race: Medicine, Natural Philosophy, and Human Diversity in Eighteenth-Century Brazil

Patrícia Martins Marcos

Patrícia Martins Marcos

To the early modern imagination, Brazil was a land of natural and human wilderness. I investigate this metonym by focusing on the centrality of human beings and their bodies to Portuguese projects of imperial expansion. I trace changes between Aristotelian views of humanity ascribed to Jesuit missionaries, compare them to emergent secular ideas on the pliability of human nature, and contrast both these models to Alexandre Rodrigues Ferreira's (1756-1815) effort of applying the Linnaean grid of natural classification to Brazilian nature and its naturals. Portuguese emphasis on agricultural labor and miscegenation hinged on the body as a key to colonization. My study of the Directório dos Índios law (1758-1798) explores how after the 1750 border expansion, Amerindians were redefined as royal vassals with the aim of augmenting the population and settling the new imperial border. Stress on natural improvement drew from medical-humoral ideas positing

that uncivilized Índios could harvest their new Portuguese natures by farming the land and rationally transforming their natural environment. Additionally, focus on monogamy and miscegenation redefined the female indigenous body as the epicenter of a new colonial frontier. Contrary to the Directório's project of human transformation, Ferreira's Amazonian journeys (1783-1792) foreshadowed the emergence of a racialized discourse. Ferreira's focus on accommodating Brazilian nature to a Linnaean taxonomy intimated a schematic view of botanical and human nature. Bodies were no longer porous and subject to fluidity or modification because their place in the system of nature was now fixed to a set of essential, immutable corporeal characteristics.

Aspects of Scientific Practice/Organization | Latin America | 18th century | History of the Body, Natural History, Scientific Racism, Scientific Expeditions in Brazil, Enlightenment Science, Science in the Portuguese Empire, Enlightenment Medicine

From Scientific Understanding to Ideological Fantasy: Chinese Image of Arabic Astronomy in the 16th to 17th Centuries

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During the Hongwu Reign (1368-1398) of the Ming Dynasty, a set of Zij was translated into Chinese under the Chinese title Huihui lifa (Chinese-Islamic System of Calendrical Astronomy). This paper will try to show how the Zij was looked upon and understood by Chinese astronomers thereafter. In view that the Zij contained some astronomical techniques that Chinese astronomy did not cover, Chinese astronomers kept a high opinion on Islamic astronomy at first. When the Datong li was found inaccurate, some of them even attempted to understand the scientific principles of the Zij in order to seek the inspiration for a calendar reform. With very little knowledge about the underlying astronomical theories of the Zij, however, their explanations and discussions of the Zij are full of misunderstandings and mistakes. A systematic introduction of European astronomy into China in the 1630s to 1640s brought about a correct

understanding of the scientific principles of the Zij, but due to the lack of the knowledge about the cultural background for its development, an earlier imagination about its origin was activated and evolved into a cultural fantasy concerning the origin and dissemination of Indian, Islamic and European astronomy and religions.

Physical Sciences | East Asia | Chinese Dynasties/Centuries | Transcultural Dissemination of Scientific Knowledge, Arabic Astronomy, Chinese Astronomy, Science and Ideology

From the Hague to Geneva: The World Order of the League of Nations

Erwin Dekker

Erasmus School of History, Culture & Communication

In the 1930s two studies were published by the League of Nations which both had a large influence on the development of economics. The first was a report on the theories of the business cycle by Gottfried von Haberler, the second one a statistical test of the various theories of the business cycle by Jan Tinbergen. This paper studies the institutional context in which these two studies, and in particular that of Tinbergen, were drafted. It argues that they are best understood as outcomes of joint

work under the supervision of Alexander Loveday and Dennis Robertson, and with the help of various assistants, co-authors and expert committees. Although commissioned and published under the names of particular authors and typically understood as monographs, the studies are better understood as attempts to create expert consensus. This is demonstrated through a detailed study of the writing of the Tinbergen report. The process demonstrates at once the various co-authors and internal critics involved and the contested nature of virtually all aspects of the study, as well as the potency of this new collaborative teamwork without which the study would have been impossible. The fact that this report was meant to forge expert consensus means that the infamous critique by John Maynard Keynes of both studies should be understood, at least in part, as a challenge to the League of Nations as an institution, and this new type of consensual expert knowledge more broadly.

Social Sciences | Europe | 20th century, early | Economics, business cycle, Jan Tinbergen, Alexander Loveday, Dennis Robertson, Gottfried von Haberler, consensus

Fugitive, Cryptic, Queer: Fungal Forms of Belonging

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No other organism better represented the nebulous boundary between botany and zoology in the Victorian imagination than fungus. For the first half of the nineteenth century, it was not clear whether fungi should be classed with plants or animals. Although, by the end of the century, the taxonomic confusion was resolved by creating a new third kingdom, fungi were still figured as “quasi-animals.” Hunger for flesh—as well as a resemblance to flesh—continued to animate fungus in the Victorian imagination. As animacy structures hierarchical logic, the animatedness of fungus became an important testing ground for the taxonomic ranking of quasi-animals and quasi-plants in the Victorian period. Taking a long view of mycological history, this paper will consider how fungi model fugitive, cryptic, and queer forms of belonging that open the body and the body politic to modes of collectivity that trouble the equation of ecology with holistic closure. Even as mycological research helped to police biological hierarchies, fungal

life also indexed the difficulty of pinning down lifeforms that flourished in the interstices of taxonomic orderings, creating a space where alternative narratives of life, intimacy, and relationality could emerge. As this paper will show, the geographies of desire and belonging created through fungal intimacies make it impossible to speak of either the self-contained individual or ecology in the singular. Open and plural, selves and worlds proliferate, contaminate, and interpenetrate through the infectious touch of fungal relations.

Tools for Historians of Science | Europe | 19th century | Victorian, Fungi, Ecology, Queer, Intimacy, Animacy

Geophysical Collaboration under the U.S.-U.S.S.R. Environmental Agreement of 1972: Peaceful Coexistence, Collaborative Circles, and Friendship Dynamics

Anna Amramina
University of Minnesota

When the U.S.-U.S.S.R. Agreement on Cooperation in the Field of Environmental Protection was signed in 1972, the two nations had limited previous experience in joint scientific work in earth sciences outside the International Geophysical Year. Constraints in communication, scarce access to

data and publications, and national security challenges of joint geophysical research inhibited scientific dialogue. While global circulations of scientific knowledge never truly ceased, professional ties between American and Soviet core-level science practitioners of two post-WWII generations had to be (re)invented in a new setting. The political détente and the environmental agreement created a necessity to develop channels and strategies of communication that had to differ even from the previous U.S.-U.S.S.R. scientific and student exchanges in the 1950s-1960s. Now American and Soviet scientists were to face each other in informal settings without an established protocol of interaction, in the lab and field, in real time. This paper explores the ways in which non-trivial real-life experiences (relocation, cohabitation and survival in the field, and exposure to different intellectual, aesthetic, and everyday cultures) shaped the relationships between American and Soviet core-level geoscientists, who participated in joint projects in seismology, paleoclimatology, and atmospheric studies under the 1972 agreement. Tracing the creation and dynamics of collaborative practices

in these bilateral circles through the stories of participants, as told by themselves in interviews, their personal papers, institutional records, and popular press, offers an additional layer of understanding how exchange, sharing, and co-creation of scientific knowledge was made possible and consistent through personal connections.

Earth and Environmental Sciences | Europe | 20th century, late | Geophysical sciences, Soviet Union, USA, Cold War

Georg Joseph Kamel (1661-1706): Natural and Medical Knowledge in Transit between the Philippines and Europe

Sebastian Kroupa
University of Cambridge

When stationed in Manila at the turn of the eighteenth century, the Jesuit pharmacist Georg Joseph Kamel found himself engaged in encounters between European and local traditions of knowledge. Based on his local experience, he produced extensive treatises of Philippine flora, which were later printed in Europe. Focusing on the practices involved in Kamel's knowledge production, this paper will explore Kamel's strategies in translating Philippine nature from local to European contexts. I will open with an examination of Kamel's plant

classification system, which reveals categories of knowledge inspired by Filipino indigenous traditions and shows entanglements between European science and local exigencies. However, upon arrival in Europe, these hybrid categories found little understanding among sedentary European naturalists and became lost in translation. Kamel was more successful in his attempts to transplant Philippine medicinal herbs. Through building associations with plants described by canonical authors of the Old World, Kamel sought to 'Galenise' Philippine medicinal plants – that is, to incorporate them into the Galenic medical tradition. In this manner, Kamel endowed plants with clear theoretical foundations comprehensible to European experts and customers and paved the way for their deployment on both local and global scales and markets.

Thematic Approaches to the Study of Science | Southeast Asia | Cultural and cross-cultural contexts, including colonialism in general

Guidance Counseling in the Midcentury United States: Measurement, Grouping, and the Making of the Intelligent Self

Jim Porter

Hugo Valentin Centre, Uppsala University

This article takes up National Defense Education Act (NDEA) and NDEA-related calls in the late 1950s for the training of an emergent profession—the guidance counselor—which was to play an instrumental role in public schools in both the measuring and placement of students in schools by “intelligence” or academic “ability.” My analysis will show that, according to its advocates, guidance counseling would not only inform the self-understanding of the measured individual, but it would also work to condition the ideology of individual “intelligence” across numerous layers of social life around the student: through peer group, through teachers and school administrators, and finally through home, family and wider community. But these policy arguments related to testing and counseling were occurring not just in the wake of the NDEA, but also in the very recent context of *Brown v. Board of Education* (1954), the far-reaching Supreme Court mandate to

desegregate public schools. Thus, I argue that a large portion of nationwide unease among whites about desegregation—which was perceived at root as a problem of contact and grouping—was translated, at least in part, into calls for increased and more systematic grouping of another kind, now by individual “ability” or “intelligence.” This shift in grouping would occur within an integrating yet also a rapidly stratifying public school curriculum. I have begun this argument elsewhere, and further develop it here by demonstrating the role guidance counseling was supposed to play in this process.

Thematic Approaches to the Study of Science | North America | 20th century, early | Intelligence testing, National Defense Education Act, measurement, desegregation

Hartley’s Naturalization of the Mind

Catherine Dromelet

University of Rome 3

Allen’s book entitled *David Hartley on Human Nature* (1999) gives a careful review of the works and life of the physician and philosopher David Hartley (1705-1757). However, there has been no thorough study of the role of nerves in the naturalisation of the mind in Hartley’s work. This latter, in his

Observations on Man, his Frame, his Duty, and his Expectations first published in 1749, discusses the nature of sensations and ideas. Thereby, he takes position on famous notions of physics, physiology, and psychology of his time. In following the account of association in John Gay's Dissertation on the Fundamental Principles of Virtue, which states the possibility to explain mental pleasures and pains on the basis of association, Hartley wants to show the physical cause of this latter, as well as its moral consequences. He is very inspired by Newton, both for the theory of vibrations, and the conception of nerves as capillary. Rejecting Boerhaave's idea of tubular nerves in which the animal spirits flow, he sketches nerves as constituted by infinitesimal particles vibrating in aether. Although his explanation of sensations, ideas, and motions, is strictly materialist, Hartley insists on their mental status. By accounting for mental facts with considerations about infinitesimal material processes, the philosopher is able to show that associations of ideas actually have the power to modify the vibrating structure of our brain. It is interesting to see, from a historical point of view, how far

Hartley takes the Lockean project of naturalisation of the mind.

Medicine and Health | Europe | 18th century |
David Hartley, History of Neurology, History of
Medicine

Healing Waters of the Caribbean: Affliction and Hope in Creole Discourses on Water Cures

Kristen Block
University of Tennessee

Historians have debated the ways in which Old World cultures were transformed, merged, and informed one another in colonial spaces like the Caribbean. My research shows that healing rituals using water were part of creolized discourses that bridged physical and spiritual worlds. This paper uses both medical treatises from the eighteenth century and Africanist scholarship to argue that elemental substances like water served as loci for intercultural dialogue. Indeed, water cures were often recommended for the most stubborn of ailments, allowing popular beliefs in water's miraculous powers to flourish. Many corrosive skin ailments were linked to spiritual and humoral imbalances. European theories about water cures began to center on the idea of transpiration, the body's permeability and its ability to take in healthful substances that could "relax" the

sensible fibers of the body or correct humoral imbalances—afflictions that were themselves often-times caused by the environmental and emotional challenges of life in “the tropics.” They wrote about the power of natural springs such as the one in Bath in eastern Jamaica (named after the spa town in England) or the hot springs of volcanic islands like Guadeloupe. Yet some of the most powerful medicinal springs were discovered by maroons or enslaved healers who passed along that knowledge to Europeans. To convince afflicted persons to try a new cure, healers had to explain the power in ways that reflected local communities' shared fascination with the power of healing waters.

Medicine and Health | Latin America | Cultural and cross-cultural contexts, including colonialism in general | Medicinal springs, transpiration, holistic medicine, affliction

Henry Morton Stanley: An Explorer of Africa as a Popular Guest of Geographical Societies, 1872-1891

Maximilian Georg

Leibniz Institute for Regional Geography,
Leipzig

Before there were chairs, institutes and courses of geography at universities, the discipline had its

institutional basis in "Geographical Societies". The purpose of these more or less amateur associations, which started emerging in the 1820s, was to promote and disseminate geographical knowledge. When it came to distant, unknown lands, they received such knowledge especially from travelers. One of the most famous (or, given his involvement in the Belgian colonization of the Congo, infamous) travelers of the 19th century was the British-American Henry Morton Stanley who, between 1871 and 1889, conducted four explorations in central Africa. Upon his returns, he paid a total of twenty visits to a total of thirteen Geographical Societies in Europe, Africa, America, and Australia. He received honors from them, and gave talks about his journeys and geographical findings, concerning most importantly the sources of the Nile and the rest of the central African water system. In my paper, I analyze Stanley's talks to the Societies as they are recorded in the latter's journals. What knowledge did he convey to them, and how did he adapt his communications to the specifics of Geographical Societies of different cities and countries? Moreover, as it was an age of

intense colonialism, Stanley's knowledge on Africa had, at least for European Geographical Societies, colonialist dimensions. How did these dimensions materialize in Stanley's visits to, and invitations by, the associations?

Earth and Environmental Sciences | Africa | 19th century | Henry Morton Stanley, Geographical Societies, history of geography, history of exploration, history of scientific institutions

Heuristics in Chemistry: Friedrich Paneth and Abductive Reasoning (Serendipity)

Christoph Maulbetsch
University of Stuttgart

When asked for the secret of his scientific success, Friedrich Paneth liked to refer to “serendipity”. This illustrious word had been introduced into the sociology of science by Robert Merton in the 1950ies. Since then it has become a vogue word for all kinds of accidental discoveries, but if it is used as a description of a logic of discovery it can serve as a historiographical tool. In this narrow sense “serendipity” implies making an unexpected observation, followed by a correct abduction. The discovery by Paneth in 1917 of bismuth hydride, which I will describe in some detail, is a conspicuous example of making use

of abductive reasoning in chemistry. Notwithstanding its inherent fallibility I would like to suggest that the abduction pattern is one gateway to novelty in science. Among others, a candidate episode from the history of chemistry to corroborate this point may be Avogadro’s hypothesis.

Tools for Historians of Science | Europe | 20th century, early | abductive reasoning

History as a Policy Tool: Re-Envisioning How the Historian Might Bring Historical Thinking into Legislative Decisions

Emily T. Hamilton
University of Massachusetts, Amherst

While historians most often write to an audience of fellow historians and academics, clear exceptions are made—for instance public history efforts or the development of textbooks and curricular materials. This paper will explore the use of historical analysis specifically as a tool for policymakers to help them better understand the perception of crisis and failure in past reform efforts in math and science education, with the goal of using this analysis to inform more effective future educational reforms. This paper will explore the importance of developing accessible history for a

specific audience, with clear goals for impacting the future. Through the lens of the history of education in America, this paper will open a discussion about the goals of science and technology studies, the role of the historian in reaching particular audiences, and the utility of historical analysis in contemplating the future.

Theoretical Approaches to the Study of Science
| North America | 20th century, late

History of the Earth System Sciences in the Max Planck Society

Gregor Lax

Max-Planck-Institute for the History of
Science

The history of Atmospheric- and Earth System Sciences (ESS) in the Federal Republic of Germany (FRG) is a desideratum in the history of sciences, compared to developments in other countries, especially the USA (i.e. Oreskes and Conway 2010, Weart 2008, Fleming 2005). Both the establishment of new integrative approaches in German atmospheric research and the history of ESS as a whole are inextricably linked to the Max Planck Society (Lax 2018). The talk examines the role of the MPG in the history of ESS on both the national and international level, focusing on

acteurs, institutions, networks and research approaches. Central pillars of this process were e.g. the establishment of a department for atmospheric chemistry at the MPI for Chemistry in Mainz in 1968, under the leadership of meteorologist Christian Junge, the founding of the MPI for Meteorology in Hamburg 1975, and finally the MPI for Biogeochemistry in Jena in 1996/1997. Compared to developments e.g. in the USA or Sweden, integrative research approaches in German atmospheric sciences were established with a ten year delay by Junge in the late 1960's. 20 years later Germany was one of the global leaders in atmospheric sciences and ESS. Junge and other MPG-acteurs like Paul Crutzen (nobel laureate for chemistry, and originator of the anthropocene-thesis), Klaus Hasselmann (director of the Max Planck Institute for Meteorology and the German Climate Computing Center) and Hartmut Graßl (amongst others WCRP director), built an extensive ESS-network on the

national and international ESS community.

Earth and Environmental Sciences | Europe | 20th century, late | Atmospheric Chemistry, Earth System Sciences, Christian Junge, Paul Crutzen, Klaus Hasselmann, German Climate Computing Center

Horoscopy in the Middle Ages and the Renaissance: Reflections on Astrology and Divination in Relation to Fate, Freedom, and Their Scientific Status

H Darrel Rutkin
Università Ca' Foscari Venezia, ERC
EarlyModernCosmology

In this talk, I will explore some of the causal foundations for understanding and evaluating astrological practices in medieval and Renaissance Europe. I will do so in order to approach a topic that has been bothering me for a few years now, namely, whether or not we should call astrology and its various horoscopic practices a type of mantic art or divination, and to probe—or begin to probe—what is ideologically at stake in that terminological decision. Towards this end, I will explore influential texts by Thomas Aquinas (*Summa theologiae* II.II.92-95), Albertus Magnus (*De fato*) and Giovanni Pico della Mirandola (*Disputationes adversus astrologiam divinatricem*).

My focus here will be on the more philosophical issues that, on the one hand, frame, legitimate and authorize—and on the other, attack and attempt to undermine—the many practical uses, for both individuals and society, of the broad range of horoscopic techniques in medieval and early modern Europe.

Thematic Approaches to the Study of Science | Europe | Medieval | History of Medieval and Renaissance Astrology

Houseflies and Fungi: The Septic Fringe and the Emergence of an Edwardian Biotechnology

Matthew Holmes
University of Cambridge

Despite a surge of recent scholarship on the long and broad history of biotechnology, the Edwardian era does not immediately spring to mind when considering the engineering of life. Yet the early twentieth century saw an ambitious attempt to artificially cultivate and disseminate the parasitic *Empusa muscae fungus* to destroy the housefly (*Musca domestica*). This paper argues that the development of Edwardian biotechnology and its modern legacy, or lack thereof, can be explained with reference to the septic fringe: a zone at the periphery of human settlements associated with waste, vermin and disease

vectors. During the late nineteenth century, bacteriological techniques established that the housefly spread disease, indelibly linking it, along with the microorganisms it carried, to the septic fringe. Yet in 1912 Edgar Hesse successfully cultivated *Empusa muscae* at the Working Men's College in London. His ambition to use the fungi to exterminate the housefly was short lived, thwarted by technical difficulties and the realisation that the fungus also carried harmful pathogens. Although *Empusa muscae* was ultimately relegated to the septic fringe, its counterfactual history offers us a glimpse at a little-known, yet surprisingly familiar, world of biotechnological aspiration and controversy.

Biology | Global or Multilocational | 20th century, early | Biotechnology, houseflies, septic fringe

How the Choice of Model Phenomena Matters: Pigmentation and the Conceptualization of Gene Action in Early Genetics

Robert Meunier
University of Kassel, Germany

Much has been said about how the choice of experimental organisms matters, how they open possibilities and impose constraints on a research

program and often push an inquiry in an unexpected direction. The same might be said about the kinds of phenomena researchers come to study as representative of a broader class of phenomena. Geneticists in the early twentieth century studied many characters to understand the patterns of heredity and their underlying cytological basis. Nonetheless, the color of flowers, seeds, or other parts of plants, as well as the color of fur and eyes in animals, were particularly prominent objects of study. Some researchers relied entirely on the phenomena of pigmentation in their projects; others worked with many characters but used the inheritance of color as a prime example in theoretical considerations. Most interestingly, the focus on pigmentation afforded possibilities for interfield transfer and collaboration between genetics and organic chemistry. In that way, it played an important role in shaping the conceptualization of gene action in early genetics. I will follow pigmentation as a research object in genetics from early Mendelian debates to the work of Beadle and Ephrussi in the US and

France, and Kühn, Caspari, and Butenandt in Germany.

Biology | Global or Multilocational | 20th century, early | interfield practices, chemistry, botany, coloration,

How the West Was Lost: Revisiting the Supposed Failure of Anglo-American Theoretical Biology

Erik Peterson
University Of Alabama

In the summer of 1929, Raymond Pearl, editor of the *Quarterly Review in Biology*, responded to English biologist J. H. Woodger with a warning. Woodger had submitted a lengthy, sophisticated essay on theoretical biology to the *QRB*. Though he recognized it as an important contribution, Pearl thought it would not fly with the journal's editorial board. "Most working biologists, at any rate in America," cautioned Pearl, "do not like to think and look with a very fishy eye on anything which savors of philosophy." This essay begins with Raymond Pearl's claim. Was it true that theoretical biology foundered in the interwar period in the United States? If so, why? And how unique was the US? Woodger collaborated with Continental biologists but found the inspiration for his own theoretical biology

amidst English philosophers Bertrand Russell and Alfred North Whitehead. So, did biologists in the United Kingdom fare any better in fostering theoretical biology than in the US? In order to answer these questions, this essay will weigh claims by historians of the life sciences that, "ideas of science come second in every sense, to the work of science" (Endersby 2007) against the methodological and sociological trends in Anglo-American biology in the mid-twentieth century.

Biology | Global or Multilocational | 20th century, early | Theoretical Biology, Joseph Henry Woodger, Raymond Pearl, Bertrand Russell, Alfred North Whitehead

Huxley's Loudspeaker: Dystopian Sounds of Control during the Cold War

Alexandra Hui
Mississippi State University

In this paper, Hui examines the proliferating and often conflicting attitudes about background music in laboring and public spaces from the 1940s through the 60s. It was alternately described as a tool of fascism, a tool of communism, a solution to petty crime, a form of therapy, a delightful experience. The power of the disembodied voice mattered but even more so, the loudspeaker itself mattered.

Anxieties about the power of the state were refracted through the form and function of loudspeakers. Psychologists performed experiments to better understand how people experienced sounds generated by loudspeakers. Sound engineers refined techniques for generating realistic, or at least believable, sound effects. We can interpret some of this as indications that the listening public developed new standards and credulities. This shift was further reinforced by the use of loudspeaker sound in dystopian literature to advance narratives, suggestive of a public that not only recognized the ironies and sonic experiences of these supposedly futuristic soundscapes (so, can create them in their minds' ears) but also created new ones. That is, the act of reading about futuristic sound as a tool of the state, reflected and reinforced new understandings of the environment.

Technology | Global or Multilocal | 20th century, early | sound, hearing, control, popular culture, states, psychology

Image and Idea in the History of the Earth, 1650-1750

Wouter De Vries
Vrije Universiteit, Amsterdam

The seventeenth century witnessed a surge of studies that deal with the interior, history and make-up of planet Earth. In the realms of theology, (biblical) history, mining, geography, alchemy or the study of fossils, natural philosophers and other specialists were exploring the different histories of the Earth's creation, development and make-up. Over the course of roughly a century, the understanding of 'Earth' changed radically – not only in terms of ideas, but also in terms of representation. Many of the works that dealt with the subject include rich and complex illustrations. Moreover, the status of visual knowledge notably changed in this period, as did the way in which visual knowledge was produced and constituted. In the case of the earth, the epistemological nature of visual material is even more complex: one of the great problems these authors were facing was the fact that they are discussing (and representing) something that cannot be seen, but has instead to be imagined. The use of visual material both shows the changes in visual epistemology in

this period, as well as the intricate relationship between image and idea. This paper will study the role of visual material seventeenth and eighteenth century (1650-1750) studies on the history and nature of the earth. With special attention for the role that visual material plays in constituting and facilitating changing conceptions of 'earth', it focuses both on key players such as Leibniz and Descartes as well as the publishers and illustrators that shaped these works.

Earth and Environmental Sciences | Europe |
17th century | Earth, History of the Earth, Visual
Epistemology

Image-Making Inside and Outside the Academy: The Artists of the Paris Academy of Sciences

Katherine Reinhart
University of Cambridge

The early Royal Academy of Sciences relied on images in the process of their natural philosophical work. Drawings and prints helped communicate new ideas, inventions, and observations, and they circulated both within Academy meetings and to wider audiences. While many members of the Academy made drawings in the process of their investigations, they relied on professional artists to

create engravings for their published works. Some of these images, such as the large engraved plates by Sébastien Le Clerc (1637-1714) were celebrated for their artistic skill as well as scientific accuracy. Yet despite the fame of these images, surprisingly little is known about the how the Academy negotiated their relationship with the artists who created them. Still further, the background and training of these artists have been neglected by scholars, nor has their work outside the Academy been taken into consideration. This paper will explore the relationship between the Academy and the artists they employed in the larger context of their artistic and graphic practices. Le Clerc, as well as Abraham Bosse (1604-1676), Louis de Châtillon (1639-1734), and Nicholas Robert (1614-1685) all created prints for the Academy's earliest folio volumes in the 1670s. But if Le Clerc's images were celebrated, ones by the others ran into problems, with the artists and Academicians disagreeing on the best means of representation. This paper will examine how these artists balanced artistic convention and tradition on the one hand, and the patronage demands and

expectations on the other – to varying degrees of success.

Aspects of Scientific Practice/Organization | Europe | 17th century | Art, images, print, artists, Paris, Academy of Sciences

Imaging the Planets in 3D: The Introduction of Computer Art at NASA's Jet Propulsion Laboratory

Rebecca Perry
Independent scholar

In 1977, a pair of unmanned spacecraft built by NASA's Jet Propulsion Laboratory (JPL), launched on a mission to explore the outer solar system. As the spacecraft arced toward Jupiter, JPL's team of imaging scientists prepared to receive and shape data collected by Voyager's scientific instruments into high-resolution photographic images. A second team of young computer scientists and artists began a parallel project—creating computer-generated films simulating the spacecraft's journeys. The Computer Graphics Laboratory (CGL), headed by manager Robert Holzman, included a newly-graduated computer-graphics researcher, 2 novice systems programmers, and an artist-in-residence. This paper explores the introduction of 3D computer graphics and computer art to NASA

at a transitional moment in astronomy—the born-digital era, characterized by a decisive shift from earlier, photographic techniques to real-time, digital collection of data (McCray, 2014). The CGL mixed image data with 3D simulation in a cinematic hybrid that was fascinating to journalists, the public and to writers and filmmakers from nearby Hollywood. 3D computer graphics intervened in scientific observation by shifting the point of view, moving the narrative backward and forward in time, or simulating future events. While computer-assisted image processing was a well-developed concept at NASA/JPL by 1977, computer graphics and computer art were both in their infancy. Visitors to the CGL saw new views of the heavens unfold through animation and art, mediated by the computer, as boundaries blurred between image processing and artistic interpretation, as well as between machinic and human vision.

Physical Sciences | North America | 20th century, late | Art, Astronomy, Digital Art, Computer Science, Planetary Exploration

In Europe

Jeroen Van Dongen

As the American History of Science Society holds its annual meeting in Utrecht, one of the key academic centers on the European continent, one may surmise that the field has returned home. Yet, this hardly reflects how today's world of scholarship is constituted: in the historiography of science, "provincializing Europe" has become an important theme, while the field itself, as is the case across the world of academia, is centered around a predominantly American literature. At the same time, ever since historians of science have emancipated themselves from the sciences a long time ago, they often have appeared, in the public eye, to question rather than to seek to bolster the authority of the sciences. How has this situation come about, and what does it tell us about the world we live in today? What insight is sought and what public benefit is gained by the historical study of science? As we try to answer these questions, we will follow a number of key mid-twentieth century historians in their Atlantic crossings. Their answers to debates on the constitution of the early modern 'scientific revolution' or the novelty

of the work of Albert Einstein will illustrate how notions of 'center' and 'periphery' have shifted—and what that may tell us about being 'in Europe' today. Jeroen van Dongen is Professor of History of Science at the University of Amsterdam. He studies black holes, Einstein, and themes that cut across science in its Cold war contexts and general questions of how to conduct historiography. He has taught and researched at Utrecht University, the Max Planck Institute for the History of Science in Berlin, and the Einstein Papers Project at Caltech.

Tools for Historians of Science

Influences of Greek Geometrical Analysis on Maimon's Notions of Analysis

Idit Chikurel

University of Potsdam

It is often claimed that analysis is grounded on the principle of contradiction alone and synthesis is grounded not only on the principle of contradiction but on pure intuition as well. This distinction is inaccurate. In my talk, I discuss the notion of analysis as something that can be grounded on sensibility as well. For this purpose, I present practices of Greek geometrical analysis and discuss how they

shaped philosophical and mathematical notions of analysis that are broader than merely logical analysis. I present the case of the philosopher Salomon Maimon (1753-1800) and his work on the different notions of analysis. Maimon's work on analysis is entwined with his work on invention. When writing the outlines of a theory of invention, he turns to Euclidean geometry and practices of Greek geometrical analysis as his main source of influence. This influence is extended not only to his formation of methods of invention but also to his notions of analysis and invention. He presents several notions of analysis, philosophical and mathematical, that are grounded not only on the principle of contradiction but on intuition as well. My discussion of such influences will be accompanied by examples taken from Euclid's *Elements* and *Data*. This study of the different forms of analysis is meant to shed light on the less known aspects of the concept and its practices.

Mathematics | Europe | 18th century | Salomon Maimon, Greek geometrical analysis, Analysis, Synthesis, Invention, Euclid

Infusoria: New Prospects for the History of Life

Joan Steigerwald
York University

Infusoria captured the attention and imaginations of naturalists and philosophers in the years at the turn of the nineteenth century. From Georges-Louis Leclerc de Buffon and Denis Diderot through Erasmus Darwin to Gottfried Reinhold Treviranus and Lorenz Oken—a diversity of figures explored, experimentally and conceptually, the presence of vital molecules or simple beings at the boundary of the living and nonliving. Experiments on spontaneous generation were repeated again and again, with each new set of trials calling into question earlier results. It remained unresolved whether infusoria were newly existent beings or vestiges of life already there. Many naturalists regarded infusoria as transitional entities complicating distinctions between the organic or inorganic. Many naturalists also regarded infusoria as the composite parts of more complex organisms, like fragments of polyps, that enabled living beings to transform and to regenerate their form. Infusoria thus became important for imagining the development and evolution of life.

This paper looks at the place of infusoria in Gottfried Reinhold Treviranus's *Biology* and Lorenz Oken's *Naturphilosophie* in particular. It explores how their study of these active and animate material entities introduced new prospects for the history of life.

Tools for Historians of Science | Europe | 19th century | Treviranus, Oken, Spontaneous Generation, Generation, Transformation

Innocence in Cases of Infanticide: Dutch Forensic Medicine and Psychiatry, 1925-1950

Willemijn Ruberg
Utrecht University

In cases of infanticide, forensic medicine has always played an important role, examining the baby's and the mother's body. The mother's mind and her emotional state were to some extent relevant in the nineteenth-century courtroom, but in the twentieth century psychiatry gained more influence in the Netherlands. Forensic psychiatrists applied the notion of 'puerperal psychosis' in the first decades and different concepts from psychoanalysis by mid-twentieth century. Several notions of innocence, related to unaccountability and insanity, interact in these cases: whereas

forensic medicine searched for clear signs of murder on the body, forensic psychiatry aimed to explain the act of child murder by referring to the mind – especially psychoanalytic explanations revolving around femininity, sexuality and motherhood. Moreover, more general cultural images of gender influenced both psychiatry and the law. In the nineteenth century, young unmarried women were often seen as the innocent victims of a patriarchal system which left them unprotected, even if they were guilty of infanticide. This image of innocent girls can still be traced in the twentieth century, but seems to have been in tension with psychoanalytical views on femininity. This paper will explore these different conceptions of gendered innocence in forensic medicine, psychiatry and (legal) culture, arguing that murdering mothers continued to baffle the law and science in an age of increasing trust in forensic science and its regime of truth, because women and motherhood remained a mystery.

Medicine and Health | Europe | 20th century, early | Gender, Motherhood, Infants, Murder, Dutch Psychiatry

Insects and Empire: Entomological Expeditions and Biological Pest Control in Early Twentieth-Century Hawai'i

Jessica Wang

Invasive insect species became a constant preoccupation of agricultural officials in the U.S.-governed Territory of Hawaii during the early twentieth century. Biological control constituted the primary means of pest control at the time, and the territory's Board of Commissioners of Agriculture and Forestry regularly deployed entomologists to distant parts of the world in order to collect and introduce insect parasites that could keep populations of unwanted insects in check. This paper examines two such expeditions—Filipo Silvestri's 1912-13 search for parasites in west Africa to combat the Mediterranean fruit fly, and David T. Fullaway's effort to find melon fly parasites in south and southeast Asia in 1914-15—in order to understand the inter-imperial networks that undergirded tropical agriculture as a disciplinary formation of empire. The history of entomological expeditions and biological pest control in Hawai'i speaks to the trans-Pacific and global ecological relationships that

conditioned imperial agriculture and governance during the era of high imperialism in the late nineteenth and early twentieth centuries.

Earth and Environmental Sciences |
Australasia/Oceania | 20th century, early

Institutional Lives: Biography as Analytical Tool for a Unified Narrative of International Scientific Organizations

Roberto Lalli

Max Planck Institute for the History of
Science, Berlin

Scientific institutions have long occupied a central position in the processes of production, transfer and certification of knowledge. Since their establishment, such organized bodies developed their own identity traits, became actors with a variety of functions in world affairs, and underwent temporal transformations. Taken together, these features make institutions particularly suitable to be described in anthropomorphized terms. It comes as no surprise, then, that historians have often made use of biographical terminology to narrate the stories of these kinds of bodies. It remains an open question, however, whether there is a substantial gain in understanding the histories of scientific institutions as biographies or whether the biographical terminology is rather

employed at the purely metaphorical level. In the present paper, I address from the historiographical perspective the concerns of applying a biographical approach for analyzing, understanding, and narrating the stories of particular kinds of scientific institutions: international nongovernmental bodies devoted to assessing, certifying, standardizing and diffusing scientific knowledge in physics across national borders. By discussing episodes from the ‘lives’ of the International Committee on General Relativity and Gravitation (1959-1974) and of the European Physical Society (1968-present), I shall argue that, notwithstanding its various limits, the biographical approach is a useful analytical tool as it allows to address in a unified narrative the multiple functions, both scientific and political, of these sorts of organizations.

Tools for Historians of Science | Global or Multilocational | 20th century, late

Instruments in Research Experiments and Their Educational Representatives

Peter Heering

Europa-Universitaet Flensburg, Germany

Several experiments from the history of physics were adapted for teaching

purposes – most of them originate from the long nineteenth century. These references to historical experiments can be found both in school teaching as well as in university lectures. Most of these experiments were introduced through discussing them and pointing out the relevance of their conceptual outcomes. Others, and these are in the focus of this presentation, were represented by instruments that were (and in some cases still are) demonstrated in the lecture. Obviously, these instruments that were demonstrated were neither the original research instruments, nor exact copies of them. Instead, these devices were educational versions of the instruments used in the historical experiments. Consequently, these didactical devices had communalities, but also discrepancies with the historical research instruments. In my contribution, I will particularly discuss two types of teaching devices: one group consists of teaching devices that address the procedural aspect of the historical experiment; the other group addresses the product (the data or the content) of the historical experiment. From this comparison, a

more thorough understanding of what was to be represented and taught with these devices can be derived. In my analysis, I will mainly address teaching demonstrations from the early 20th century, but also take a look at recent demonstrations.

Social Sciences | Europe | 20th century, early | science education, scientific instruments, historical experiments

Instruments, Observations and Observatory Science on Ben Nevis

Simon Naylor
University of Glasgow

Intellectuals, Illustrators, and Insects: Three Stories from Continental European Entomology, 1764-1812

Dominik Huenniger
University of Hamburg

By using three different examples from Denmark, France and Germany, this presentation highlights the diversity of image production in the formation process of scientific entomology in Europe. It will explain methodological debates around making knowledge claims as well as the social contexts of late 18th century entomology. In 1764, the Regensburg parson Jacob Christian Schaeffer had trained a considerable number of illustrators

to assist him in producing his entomological textbooks. Concerning the training of his helpers, he used a term usually restricted to the training of dogs: “abgerichtet”. Hence, social superiority claims played an important part in the development of the discipline. The authors of entomological handbooks were largely university-trained scholars who employed illustrators from a range of social backgrounds. This is especially apparent in the lavishly illustrated “Papillons d'Europe, peintes d'après nature“ which was published in Paris in eight volumes from 1779 to 1792. The wealthy bureaucrat and collector Gigot D'Orcy employed almost 20 engravers and illustrators from France and Germany. This work exemplifies the collaborative nature of entomological book production. It also highlights the importance of women, as one of the contributors was the Frankfurt illustrator Maria Eleonora Hochecker. The professionalization of entomology, especially in its applied aspects however meant that formal training was restricted to men. At the beginning of the 19th century applied entomology was mainly connected to the establishment of

scientific forestry. An example from the forestry school at Kiel, then belonging to Denmark and the use of images there will round off this presentation.

Biology | Europe | 18th century | Entomology, Art, Material Culture, Gender; Applied Science, Forestry, Images

Interglacial Victorians: Ice and the Natural End of Time

Alexis Rider

History and Sociology of Science,
University of Pennsylvania

This paper explores how naturalists in the nineteenth century used ice to understand geologic timescales. Further, it considers the broader cultural representations of the past and future of the planet, in which ice was deployed as a register, index, and interlocutor of geologic time. I focus on Britain in the late-nineteenth century, when the temporal agency of ice was leveraged by geologists, physicists, and authors of popular literature to make claims about the past—and future—of the earth. As geologists read the earth and imagined a world that had once passed through an Ice Age, physicists, wielding the second law of thermodynamics, asserted an inevitable and final return of ice: as energy dissipated, the universe would cool, rendering earth a frozen

and barren place. Victorians were thus positioned as ‘interglacial beings,’ existing precariously in a fortuitous moment of melt, and ice was cast as an apocalyptic threat that—unlike earlier theist prognostications—was based on laws of nature (Wood, 2018). These scientific assertions had wide cultural ramifications: the trope of ice as a natural enemy of humanity proliferated, particularly in the nascent genre of Scientific Romance, the precursor to science fiction. These early Scientific Romances, normally seen as evidence of industrial optimism or anxiety, reveal a growing popular preoccupation with environmental threats operating on deep temporal scales. I thus argue that ‘Interglacial Victorians’ were deeply engaged with the relationship between human and geologic temporalities—a relationship that is often seen as unique to late-twentieth century environmental consciousness.

Earth and Environmental Sciences | Europe | 19th century | deep time, objects of temporality, ice, futures, apocalypse, literature.

Interracial Encounters in an Era of Identity Politics: The Study of Population Admixtures in Italy after the Second World War

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Scientific interests in both the origins and the respective qualities of the different “races” (or “stocks”) that made up the Italian population predated the unification of the country, when they prompted heated political debates. However, the question gained further actuality in the interwar period, when the Fascist government launched a highly ambitious policy that aimed to reclaim vast amounts of marshlands located in different regions of Italy. As tens of thousands of peasants from the North East of Italy were moved around the country to drain swamps and cultivate the reclaimed land, anthropologists and biologists undertook to study both their adaptation to the new environment, and the product of their intermixing with “autochthonous stock”. Remarkably, the interests in the intermixing of Italian populations did not disappear with the fall of the Fascist regime. On the island of Sardinia, for example, a team of anthropologists and geneticists of

local origin carried on studying the prevailing “human ecology” of the newly reclaimed lands, up into the 1970s. More surprisingly even, they built on their studies to take a stance in then ongoing political and cultural discussion on Sardinian identity and its future. The aim of this presentation is to explain how a racial style of thought that dated back to the late 19th C. was successfully adapted to the new context of Identity politics.

Biology | Global or Multilocational | 20th century, late | race, physical anthropology, genetics, Italy

Involuntary Motion and the Origins of Aesthetic Experience, 1700-1750

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It used to be widely accepted that the eighteenth-century emergence of the 'aesthetic' as a category of experience and philosophical inquiry depended on an explicit denial of the pleasures, pains, and functions of the body. In recent years, however, scholars have become increasingly interested in how medicine and theories of matter shaped the development of art criticism and philosophical aesthetics. In this paper, I argue that changing ideas about the body's involuntary

functions - along with their pathologies and therapies - had a crucial role in the development of aesthetics and art theory in Britain during the first half of the 18th century. Drawing on a wide range of sources concerning the imperceptible motions of plant and animal bodies, I show how debates about the the body's involuntary responses to the world outside it shaped claims about what we now call aesthetic experience - the experience of beauty and sublimity. This paper will do more than simply show that art theorists such as Jonathan Richardson and William Hogarth responded to philosophical and medical attempts to describe and control the body's involuntary motions. Rather, it will seek to demonstrate that a concern about involuntary motion was a central theme in 18th century thought, animating a range of interconnected discourses and practices concerned with the mind's non-cognitive or affective responses to sensory experience. Those ranged from debates about the how invisible attractive forces shaped the temperaments to questions about the forms of experience arising from

mysterious, involuntary vibrations taking place inside the body.

Thematic Approaches to the Study of Science | Europe | 18th century | Aesthetics, Science, Affect Theory, Vibration, Medicine, Involuntary Motion

Is the Computer Scientist a Mathematician? The Question of What Should Become of Computer Science at Stanford, 1960-1965

Tasha Schoenstein
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In the early 1960s, a semiautonomous Division of Computer Science existed within Stanford University's Department of Mathematics. While the division had initially grown out of interest in numerical analysis within the mathematics department, members of the computer science division became increasingly frustrated with the limits their relationship with mathematics placed on their growth and their ability to direct the future directions of computer science at Stanford. The computer science faculty was interested in branching out from its early emphasis on numerical analysis, but the division's position within the mathematics department complicated efforts to include contested or less "mathematical"

subfields such as artificial intelligence. I will argue that the mathematicians and computer scientists used different notions of what was mathematical and what made a good mathematician to pursue certain desired relationships between mathematics and computer science at Stanford. While the historical scholarship addressing the relationship between mathematics and computing or computer science has largely focused on specific subdisciplines or on public conversations and widespread discourses (Dick, Ensmenger, MacKenzie, Mahoney), this paper expands on this literature by examining how the institutionalized relationship between mathematics and computer science within the university context mattered to the early development of computer science as an autonomous discipline. In doing so, it contributes to the history of mathematics, the history of computing, and the history of the disciplines.

Mathematics | North America | 20th century, late

It's Very Difficult to Sing a Daisy: Adventures in Aesthetics and Experimental Phonetics at the Turn of the Century

Michael Rossi

Among the many passing fascinations of turn of the century America, consider the eidophone pictures of Welsh singer Megan Watts Hughes. An accomplished vocalist, Watts Hughes discovered that singing into a mouthpiece connected to a resonant plate upon which had been placed a thin film of paste would cause the paste to contort into strange and wonderful shapes. By carefully modulating her voice as she sang into the mouthpiece-plate-paste apparatus — which she called the “eidophone” — Watts Hughes could cause pictures to appear at will: surreal landscapes, spiraling abstractions, even pansies, roses, and other flowers of specific type and species. It was notably difficult, however, to “sing a daisy,” she said, because of the extremely low tones and precise control required. This paper will take Watts Hughes’s pictures as a jumping off point from which to explore the field of experimental phonetics in the United States at the turn of the century. By no means the first instance of “hearing with the eyes,”

as one scientist put it, Hughes's "voice graphics" nevertheless caused a stir among physiologists, psychologists, and physicians in the United States who believed that transducing sound into vision was the best way to study speech. In the nuances of precisely-recorded human vocalizations – whether made from eidophones, vowel-tracers, phonoscopes, or other recording devices – practitioners of experimental phonetics found new methods for treating speech "disorders" and new ways for (literally) envisioning the neurological and cognitive roots of language. At the same time, the difficulty of "singing a daisy" wasn't simply practical – in deciding on the meanings of the tracings that their machines produced, researchers also faced questions about formalism, aesthetics, interpretation, and the correspondence between representation and the notional real.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 20th century, early

Italian Naturalists, Patrons, and Painters: Methods of Collecting and Studying Plants and Aquatic Creatures in the 16th Century

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In this paper I will focus on the period c. 1530-c.1560 and on a cluster of Italian naturalists, their painters and patrons, in order to address the following two issues. The strong visual turn of natural history and the role of non-printed images in this period; the links in terms of methodology and persons involved between the study of plants and that of (aquatic) animals. Geographically those clusters link Venice, Rome, Padua, Bologna, Trento, and some further towns of northern Italy. Some of the key persons will be Daniele Barbaro, Ulisse Aldrovandi, Pietro Andrea Mattioli and Ippolito Salviani.

Thematic Approaches to the Study of Science |
Europe | Renaissance | Aldrovandi, Mattioli,
Salviani

Itibritto' and 'Upokarita': Tracking a Historically Conscious Narration of Chemistry in Nineteenth Century Bengali Periodicals

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Partha Chatterjee in 'Texts of Power' emphasizes the need to track institutional practices while tracing the emergence of disciplines in colonial Bengal. In his account of the processes of hybridization of the natural sciences however, the role of popular periodicals is limited to merely translating science for the common public. In my paper I argue that instead of using the antiquated model of "dissemination" to understand the work of popular science, an examination of the textual universe of periodicals like 'Tattvabodhini Patrika' and 'Aryadarshan' reveals the ways in which choices of genre and practices of translation themselves were preparing readers to 'read' disciplines in particular ways. I shall study a set of writings narrating the "history of" and "usefulness of" chemistry in the early 1870s - soon after the subject was introduced in undergraduate colleges in Bengal and nearly a decade before the making of the first professional

Bengali chemists. Earlier impersonal descriptions of chemical laws and substances give way during the 70s to genres and narrative voices firmly located in the present colonial context. These perceive chemistry as an expanding field rooted in a history (part world-, part nationalist-) and wielding significance in everyday lives of readers. I argue that these vernacular writers' disputes over chemistry's origins or their call to readers to recognize it as a "useful" science must be read as interventions into the life led by the discipline within institutional sites in the colony.

Aspects of Scientific Practice/Organization |
South Asia | 19th century | Chemistry, Bengali,
Periodicals

Killing with Kindness: Adapting to Crisis in Seed Banking Protocols

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Seed banking has emerged as a solution to the crisis of diminishing plant variety due to human and mono-culture agricultural encroachment. This paper is a small piece of a larger project that studies the conditions that led to the emergence of seed banking, the diverse practices of seed curation, and the challenges to cryogenic life.

Here I consider a simple but real question: What happens when the system that has been idealized as the infallible fail-safe, is discovered to be compromised? How do scientists learn from disaster, adapt their techniques, and innovate around new needs in caring for precious dormant life? This paper follows the story of one such moment of crisis at a small but prominent seed banking facility, the C. M. Rick Tomato Genetics Resource Center (TGRC) at the University of California, Davis. Based on collections made from the mid twentieth century onwards, and from the sites of the origin of Tomato family in Andean Peru and Ecuador, the TGRC contains the biggest collection of tomato variety globally and provides samples of their collection to any bona fide researcher. However, in the fall of 2015, researchers at Cornell University discovered a viroid pathogen on tomato plants that had grown from seed sent from the TGRC. Following the ongoing struggle to understand the spread of the pathogen, treat infected seed, and repair their reputation, this paper explores the intricate relations of care for specimens and responsibility to community that are

held in tension in scientific spaces that are experiencing crises.

Aspects of Scientific Practice/Organization | North America | 21st century | Seed banking, curation, care, community

Know Thyself, Know the World: Early Modern Paper Engineering and Anatomical-Geometrical Bodies

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Advanced Study

This paper opens by considering a peculiar phenomenon in scientific history – namely, the invention of the anatomical flap-book in the 16th century, in which a reader can lift a torso flap on a picture of a seated figure to reveal the organs beneath. Thus the reader replicates the experience of the anatomist, successively uncovering the body's secrets. Usually these texts were uncomplicated, with one figure and one flap; but we will consider here a bizarre multi-flap, moving-part anatomy first published in Europe at the beginning of the seventeenth century, Johann Remmelin's *Catoptrum microcosmicum*. This anatomy was republished in England, and by the end of the seventeenth century, it contained not outdated copies of images from a prior century, but pirated

illustrations from a famous contemporary neuroscientific text, Thomas Willis's 1664 *Cerebri anatome*. Yet anatomy was not the only discipline to make use of flaps, as mathematical texts such as Sir Henry Billingsley's 1570 *Elements of Euclid* deployed similar pop-up page elements to illustrate geometrical concepts of surface area or volume. This paper will address the folded page, namely the ways in which flaps could be folded up, in, or out to replicate three-dimensional figures and spaces. As a corollary, I will consider the particular relationship such similar paper folding techniques invites (or provokes) between the disciplines of geometry and anatomy.

Thematic Approaches to the Study of Science | Europe | 17th century | history of the book, history of anatomy and medicine, history of mathematics, printing technologies

Knowing Materials

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"If you can spray them then they are real" is Ian Hacking's pithy answer to the question of when we should believe in the existence of microscopic entities we cannot see. Much history and philosophy of science has concerned the second

half of Hacking's slogan. Historians have investigated how scientists came to believe in things like electrons, neutrons, and photons. Philosophers have wondered what it means to build science around belief in unobservable entities. But the first half of the quote hints at other, more rarely told stories. When we spray electrons, or neutrons, or photons, how do we spray them? At what? To what end? The history and philosophy of science have said a great deal about the things we spray, but much less about how and why we spray them. This talk discusses the 20th-century tools that provided new insights into the characteristics of materials, and thereby redefined what scientist mean when they talk about materials. Materials are often distinguished from other matter because they can be or have been turned to human purposes. Nothing about that definition requires a robust scientific understanding of materials have useful properties. The proliferation of tools for characterizing materials brought that knowledge within grasp. These tools helped fuse the many traditions of materials research into a new, interdisciplinary field of materials science. In doing so, they made knowledge of the inner workings of

matter essential to the concept of materials as the substances that humans use to achieve their aims and desires.

Physical Sciences | Global or Multilocational |
20th century, late

Knowing the World's Past and Future: H. G. Wells's "The Outline of History" and Its Reception in Interwar China

Hsiang-Fu Huang
University College London

"The Outline of History" (1920) by H. G. Wells is an ambitious title narrating the "whole story of man" from prehistory to the Great War. Wells adopted an unconventional approach comprising the natural world and human civilizations together. Before introducing the dawn of early civilizations, the book starts with what we regard as "popular science" today: the Earth in the Universe, the evolution of life, and human origins. Wells's approach reflects an evolutionary perspective of historiography in the early twentieth century, which regards human society and natural environment as a coherent entity governed by scientific laws and patterns. His political agenda also shaped the title's cosmopolitan theme, particularly in the proposals

of global security and peace initiative. Well's unconventional treatment of history writing received mixed responses. "The Outline of History" was a phenomenon not only in the Anglosphere but also among Chinese intellectuals during the interwar period. Fu Ssu-nien (1896-1950) and Chen Yuan (1896-1970), who studied in London, assisted Wells in the writing of ancient China. Fu and Chen belonged to a group of liberal intellectuals advocating the New Culture Movement, which appealed for radical Westernization of Chinese society to achieve modernity. New Culture intellectuals regarded Wells's works as accessible inspirations for scientific thinking and social reform. Some Chinese pacifists and religious groups shared Wells's anti-war agenda and concerns for the abuse of scientific advances. My research shows how Wells's narrative of universal history influenced different Chinese readers' perceptions of science, progress and civilizations.

Thematic Approaches to the Study of Science |
Global or Multilocational | 20th century, early |
H. G. Wells, popular science, universal history,
progress, evolution, New Culture Movement,
pacifism

Knowledge of the Unknown: On the “Dark Figure of Crime” in 19th-Century Germany

Sophie Ledebur

“Dark figure” means estimating and calculating the number of unreported or undiscovered crimes and is therefore a statistic of hidden yet ostensibly real occurrences. The terms names something that mostly evades general knowledge and counting, and often instills angst. “Dark figures” are figures of suspicion and produce a suggestive surplus, especially in relation to crime statistics. Planning to evade crime in the first place had an immediate impact, and this kind of social engineering focussing on long-term perspectives became a crucial technology during the 19th century. The central question is how the “knowledge of the unknown” became a research area of its own, opening up new fields of intervention. To enhance their ability to survey and protect the social body, complex informational networks were established in order to gain knowledge not readily accessible to medical institutions or to the state. The paper investigates counting cards that were used in Germany from the early 1870s onwards to gain deeper information

about unknown and threatening fields like covert prostitution, potentially dangerous mental illnesses, and crime reality. The epistemological impact of these paper tools will be related to long-term prevention as the cultural technology of the modern age.

Medicine and Health | Europe | 19th century | statistics, criminology

L. Susan Stebbing and the Logic of Democracy

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Princeton University

In her *Modern Introduction to Logic* (1930), often considered the first textbook of analytic philosophy, British philosopher L. Susan Stebbing (1885–1943) presented a coherent long durée vision of the science of logic. Contrary to a caricature (popular then and now) that presents mathematical logic as an irruption of genius redeeming a heretofore worthless discipline, Stebbing construed the advent of mathematical notation and its attendant methods in logic as a cumulative triumph. She positioned the domains of logic, mathematics, and scientific method in relation to each other and within a reorganized disciplinary matrix she indicated new possibilities for the person of

the philosopher. Over the course of her career Stebbing exhibited a vision of the philosopher as a public figure at a time when it remained rare for a woman to be recognized as a philosopher at all. She asserted the need for the rigors of logic in public discourse and likewise asserted herself as an authoritative representative of that science. Striving to render the latest mathematical logic accessible to as wide an audience as possible, she used its methods to analyze found examples of misleading political discourse and stressed the importance of argumentative clarity amidst the turmoil of the 1930s. By asserting the specifically democratic value of mathematized rigor, she posited a particular social role for the philosopher as an intermediary between modern science and everyday experience—a role she held to be urgently needed in the face of pervasive unscrupulous rhetoric in the age of fascism.

Mathematics | Europe | 20th century, early

Laboratories of Cooperation: UNRRA's Conferences

Jessica Reinisch
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In this paper I will consider the format and purposes of the

conferences organised by the biggest and most impactful international organisation created during the Second World War: the United Nations Relief and Rehabilitation Administration (UNRRA).

UNRRA's many conferences, ranging from small meetings with scientific advisers to big diplomatic gatherings that debated and ratified UNRRA's policy, provide plenty of reasons why historians of science should pay more attention to the history of conferences. Conferences in all their variety have a long history as meetings of informed minds with the aims to recalibrate terms, solve problems, achieve professional coherence and define who is a member of the club.

UNRRA, as a formally 'technical' organisation, adapted the format of scientific conferences to solve intractable political problems, while at the same time drawing on older ideas about political congresses to create and steer technical consensus. One of the purposes of this paper therefore will be to point to the dual traffic of ideas and influences, between the political and scientific realms, shaping the mid-20th

century conferences of international organisations such as UNRRA.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, early | UNRRA, United Nations, medical cooperation

Languages of Broadcasting: Early Radio Research in Berlin and Princeton

Viktoria Tkaczyk
MPIWG

The emerging technology of radio posed epistemic difficulties for a range of disciplines in the twentieth century and prompted interdisciplinary initiatives such as the radio laboratory (Rundfunkversuchsstelle) at the Berlin Academy of Music, led by musicologist Georg Schünemann from 1928 to 1935, and the Radio Research Project at Princeton University and Columbia University, managed by sociologist Paul Lazarsfeld from 1937 to 1944. The defined aim of both ventures was to integrate scholars in the humanities, the sciences, and the social sciences into new forms of applied research. My paper examines these modes of applied research, with particular attention to the multiple ways in which the two projects searched for novel “languages of broadcasting.” This search ranged from the phonetic examination of radio-

transmitted speech and the development of testing and training programs for radio announcers, to the design of tailored microphone and transmitter technologies, experiments with newly defined genres such as radio journalism, and the formulation of new audience research methods and techniques of media criticism.

Tools for Historians of Science | Global or Multilocational | 20th century, early | History of humanities and social sciences, sound, technology, politics

Late Imperial Russian Ethnography and Russo-American Knowledge Exchange

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This paper will explore Russo-American knowledge exchange in the context of the Jesup North Pacific Expedition (1900-1902). This expedition was organised by the famous American anthropologist Franz Boas, and funded by the president of the American Natural History Museum, Morris K. Jesup. It involved fieldwork in both Northwest America and Northeast Siberia. For the latter, Boas employed Vladimir Jochelson and Vladimir Bogoras, two former Russian political exiles who had reinvented themselves as key

international experts on the ethnography of Northeast Siberia. Jochelson and Bogoras were both working together with their wives, who did not have backgrounds in ethnography but conducted part of the research. The Russian ethnographers' work in the Jesup North Pacific Expedition was part of a complex and challenging network of knowledge exchange. Bogoras and Jochelson were committed to the theory of social evolution which held that all human cultures passed through a universal set of stages, from the most 'savage' to the most 'civilised'. On the contrary, Franz Boas was an outspoken anti-evolutionist who studied indigenous cultures through the lens of cultural relativism. Their collaboration was highly productive yet challenging to each side's core beliefs. This paper will discuss how Bogoras's and Jochelson's views were shaped in a fascinating knowledge exchange which included American anthropologists, Russian ethnographers, their wives and the multiple indigenous ethnic groups under investigation.

Social Sciences | Global or Multilocational | 20th century, early | ethnography, race, culture, evolutionism, Russia, Siberia, America, network, knowledge exchange

Laws of Nature and Nature's Use and Manipulation According to Roger Bacon (ca. 1220-1292)

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Tel-Hai College

The idea of a general legality in nature is found in the writing of Roger Bacon already in the thirteenth century. Bacon moved towards a new conception of nature by rendering natural regularities into laws. He wrote of the law of reflection, the law of refraction, the law of the gravity of water and the laws of stars. He explained dissenting phenomena by appealing to the law of universal nature, which overrules the laws of particular natures when necessary. In this paper I ask whether Bacon suggested ways by which the knowledge of the laws of nature can foster man's control of nature and its manipulation. Indeed, the search for laws belongs, according to Bacon, to the practical part of science, since their application can enhance human lives. Specifically, he argued that according to the laws of reflection and refraction, a mirror can be shaped, so that one group of soldiers will appear as multiplied, and thus would terrify the enemy. He also suggested using the laws for the production of powerful weapons,

such as consuming, unquenchable fire, defeating sounds, blinding flashes and poisons. Did the use of the laws of nature as suggested by Bacon bring him close to the early modern idea of dissecting nature, controlling and manipulating it? I argue that for Bacon the discovery of laws resulted in the idea of the usefulness of the knowledge; he did not, however, entertain yet the idea of a planned experiment in which nature is “forced” into “unnatural” situations.

Physical Sciences | Europe | Medieval | Laws of nature, usefulness of knowledge, Roger Bacon

Lead Poisoning in France around 1840: Criminal Justice, Industrial Poisoning, and the Making of Ignorance

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French nineteenth-century toxicology was a science made for the prosecution in criminal poisoning cases – a science conceived for and mostly made in the Cour d’Assises. The main purpose of toxicologists was the detection of small quantities of poisons in corpses in order to provide unquestionable evidence in courts. This approach was based on high sensitivity tests based on

qualitative analytical chemistry and proved to be very useful in many criminal cases. It faced the anxieties of the French notables and the main political and economic powers. However, this approach could hardly be employed in cases of industrial poisoning, where other forms of evidence were needed not only to detect but mostly to prevent poisoning in workers’ bodies. These dramatic health problems in the industry were largely neglected by toxicologists, judges and decision-makers during the nineteenth-century. The paper focusses on a particular case (the Pouchon affair, 1843-1844), which took place in a crucial period, either in the development of forensic medicine (new high sensitivity methods were introduced around 1840 and a controversy took place on their virtues and delusions) and occupational health (Tanquerel des Planches published his seminal book on lead poisoning in 1840). My paper is based on studies on history of toxic products connecting research on history of crime with recent works on history of occupational health, particularly the practices of agnotology and undone science related to the

visibilization/invisibilization of toxic risks.

Chemistry | Europe | 19th century

Libraries of Life: Microbial Culture Collections and the Chemical Order of Nature

Charles Kollmer

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Historians of science have long recognized the centrality of collections such as cabinets of curiosity, gardens, and museums to the study of natural history. Until recently, conventional wisdom held that, as the life sciences became ‘modern,’ the importance of such collections was eclipsed by that of experiments. Rather than collect, describe, and arrange specimens, so the story goes, investigators opted to experiment with strategically-chosen model organisms, using them to elucidate biological mechanisms present in wide swaths of the living world. In the meantime, scholars like Robert Kohler and Bruno Strasser have challenged this view, drawing attention to the pervasiveness of scientific collections throughout the modern life sciences. In this paper, I provide a panoramic view of microbial culture collections from the turn of the twentieth century through the

1970s, arguing that the curation of these collections was not only useful for taxonomic purposes, but also indispensable for shedding light on the biochemical mechanisms of living cells. Using these libraries of life, microbiologists compared and contrasted microbes’ metabolic processes, substantiating what I refer to as ‘the chemical order of nature.’ In conclusion, I suggest that further scrutiny of collections of laboratory-cultured life forms will help rectify an imbalance in the historiography of the twentieth century life sciences, which tends to foreground histories of genetics, evolution, and heredity, while neglecting those of physiology, biochemistry, and metabolism. When histories of the twentieth century life sciences focus predominately on a handful of standardized model organisms, they only tell part of the story.

Biology | Global or Multilocational | 20th century, early | collections, experimentation, biodiversity, model organisms, biological mechanisms, biochemistry, microbial cultures, cell physiology, metabolism

Local Lives, Global Networks: Disease, Medicine, and the Entangled Histories of Assam Tea Plantations (1900-1930s)

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In making an attempt to explore the “medical incentives” and the “interests of the capitalist agencies” involved in the project in locating the vectors of diseases prevailed in the Assam tea plantations of British India, the paper argues that ideas of medical welfare was instrumental both in “building a network of tropical medicine with its professional researchers and contributed to the oppressive ‘plantation paternalism’ in the frontier colony”. To elaborate the histories of such entanglements, my paper will firstly look at the way through which the rise of metropolitan scientific institutions came to be prioritized. This will be followed by looking at how the question of transmitting and circulating of the “scientific knowledge” provided the impetus to the formation of the “cadre” of medical researchers. The third section of the paper will be engaged in providing examples of the interplay of global and local in the

rise of supposedly objective scientific practices which transformed the locally lived lives of the plantation system in the global network of tropical medicine. In tracing all these trajectories, I take the reader into the question of how the growing concern about epidemics in the tea plantations of Assam eliminated the boundary of once considered the cultural and racial basis of explaining the epidemiological character of diseases for the interest of the capital.

Medicine and Health | South Asia | 20th century, early

Locust Pests and Biological Control in Argentina during the First Half of the Twentieth Century

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In the first decades of the twentieth century, the so-called “mechanical” and “chemical” means were the most frequent answer when locust swarms threatened the crops. Different governments and administrations around the globe resorted either to the use of traps, barriers, fire or to digging up eggs along with poisoned baits or insecticides to eradicate this “natural threat”. The history of these

means in the fight against locusts - and other agricultural pests- have received much attention from scholars, especially in the case of insecticides. This tendency, however, cast a shadow on the history of the "biological" methods. At the end of the nineteenth and beginnings of the twentieth century, this enterprise was taken up enthusiastically by entomologists and other scientists worldwide and numerous trial introductions were made in the following decades under various degrees of scientific control. This implied a global circulation not only of knowledge, technologies, peoples, and instruments but also of different kind of organisms. The new field presented the promise of a natural, pest-free future for agriculture although the results obtained were controversial, particularly for combating locusts. This perspective underlined that insect pests were a consequence of an ecological/environmental disorder and its solution entailed to restore "the balance of nature". Not just to eradicate or manage a particular "plague" but to control nature. Here I will focus on this subject through the study of different experiences on locust biological control and its narratives

in Argentina during the first half of the twentieth century.

Biology | Latin America | 20th century, early | Entomology, Argentina, balance of nature

Looking at Animals Differently: Posthumanist Performativity as a Tool for Aesthetic Analysis

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This paper considers how posthumanist perspectives are actively transforming the ways of thinking around animals in the arts. With the emergence of Performance Art during the 1960s, art history starts to explore living, non-human animals. Theatre and performance studies were already confronted with them in much earlier contexts, for example in stage fights in ancient Rome or operas in the baroque era. As theatre and performance studies deal with changing, dynamic artforms, they are corresponding with newer concepts, such as posthumanist performativity. Within the posthumanist thinking, the status of non-human entities like animals changes: Animals and their agency come into focus. They are not passive or matter shaped by humans anymore, but active and actionable entities within dynamic relations. Building up on the concept of

„Posthumanism as a praxis“
(Francesca Ferrando),
Posthumanism serves as a
interdisciplinary perspective and a
tool to examine animals in the arts.
It is an active decision to go beyond
an anthropocentric perspective. I
would like to ask what happens
when we try to look at animals in art
without assuming the human subject
as our sole reference. This is
examined by analyzing the
installation *Soma* of Carsten Höller
at Hamburger Bahnhof from 2010.
In a fictional experimental setup the
artist installs reindeers, birds, flies
and mice so that the presence of
animals transforms the setting into a
performative artwork.

Theoretical Approaches to the Study of Science
| Global or Multilocational | 21st century |
animals, art, contemporary art, posthumanism,
performativity, art history, theatre studies,
posthumanist performativity, animal turn, new
materialism, anthropocentric

Looking for a Point of Observation in the South of the World: Global Astronomical Networks in the Nineteenth Century

Carlos Sanhueza-Cerda
Universidad de Chile

One of the main problems of
astronomy in the mid-nineteenth
century was to calculate the stellar
distances and build a system of

measurements that would allow to
know the positions of the stars,
distances, orbits, etc. This scientific
task required the search of a point of
observation in the south of the world
that would allow comparing data
between both hemispheres of the
earth. In 1847 Christian Ludwig
Gerling of the University of
Marburg in Germany, suggested that
the solar parallax could be
calculated by measuring the position
of Venus near its lower conjunction
from observatories in distant
latitudes, but close in a same
meridian. James M. Gillis, an
astronomer at the United States
Naval Observatory, proposed to
Gerling an expedition to Chile in
order to do observations that would
be compared with those made in the
United States. This talk aims to
analyze the uncertainties and
difficulties to build global networks
of astronomical knowledge. This
will be done by studying the
unpublished correspondence
between Gillis and Gerling. This
correspondence allows us to
understand the discussions between
both scientists about the planning
and preparation of this southern
expedition, the choice of the
observation point, the
methodological scope of the

fieldwork and the possible use of the equipment in a different hemisphere.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 19th century |
Astronomy, global-local networks, observatories

Looking for Longevity? Intersections of New Science and the Improvement of the Body

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Different forms of corporeal improvement emerged between the Renaissance and the Enlightenment. Humanists, like Erasmus of Rotterdam, tried to educate the elite and rulers in books like his how-to manual ‘*Institutio Principis Christiani*’ (1516) dedicated to Prince Charles, the future Emperor Charles V. Ecclesiastics and pious lay people trained their bodies and minds to reach spiritual discipline in order to live more righteously (e.g. Jesuits, Pietists) and possibly achieve salvation (e.g. ascetics, eremites). In the field of medicine, the physician Andrea Vesalius, among others, led the way to modern anatomy with the publication of the findings from his empirical dissections in ‘*De humani corporis fabrica*’ (1543). Generally speaking, in the Renaissance and in

the wake of the New Science, novel techniques of observation and their corresponding instruments evolved, as Gianna Pomata and Lorraine Daston have shown in their work on the ‘Observationes’ and the ‘epistemic genre’ respectively. I argue that these new empirical methods fostered the practices of corporeal experiments and the corporeal experiments in turn contributed to the New Science. My paper will show how the media and methods of observation and improvement of the body intersected in the early modern period.

Medicine and Health | Europe | Renaissance

Looking for Moral Congeniality: Lust, Love, and Physical Bodies in Eighteenth-Century Spain

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In 1726, the Spanish Benedictine friar Benito J. Feijoo (1676-1764), in his best-seller *Teatro Crítico Universal*, defended women’s intellectual capacities. Analysing medical and philosophical theories about how ideas were produced, he argued that female bodies (cold and humid) were perfectly suited to intellectual pursuits. Feijoo’s ultimate goal in demonstrating the

equality of sexes was moral. By championing women's mental capacities, he sought to prevent male sexual attacks, and buttress the bond of marriage. Specifically, Feijoo was one of many during his time who advocated that spouses needed to be morally 'congenial' (*congeniar*) for a successful marriage. To achieve such 'congeniality,' however, one had to discern a potential lover's moral characteristics from her external traits and gestures. This paper traces the shifting somatic understandings underpinning such an amorous hermeneutics, excavating the relationship between love, desire and physical bodies in 18th-century Spain. In particular, the paper addresses the rise of medical interest in erotic and pornographic representations. Across anatomical and medical treatises -- yet also disguised in painters' manuals, guides to conduct, marital and moral-philosophical works, and novels -- sensual paintings and erotic descriptions were analyzed for the different ways in which they both produced bodily effects (e.g., sexual arousal), as well as excited 'higher' sentiments (e.g., 'moral love'). In turn, these analyses were used to instruct potential lovers in Catholic Spain as to how they might

interpret visual features and performances so as to successfully distinguish between 'physical love' and 'moral love', avoiding a marriage premised on false appearances.

Medicine and Health | Europe | 18th century | gender & sexuality, pornography, religion, art

Managing Mexican Crop Diversity from Rome

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In 1983, member states of the UN Food and Agriculture Organization (FAO) adopted the non-binding International Undertaking on Plant Genetic Resources. Although ostensibly motivated by concern over "genetic erosion"—that is, the loss of genetic diversity in crop plants as a result of agricultural industrialization and environmental degradation—the 1983 Undertaking is better understood as the product of a North-South conflict over ownership of and access to seeds. Many scholars have discussed the Undertaking, aptly attending to its place within the histories of ideas about intellectual property in and national sovereignty over so-called genetic resources. Here I return focus to the place of the Undertaking within the longer history of efforts to

conserve crop diversity. Placing the often-neglected practical aspects of managing collections at the forefront, I explore the implications of the recourse to international agreement as a measure to conserve genetic diversity in crops on actual conservation practices. While Mexican delegates to the FAO led the protracted battle of the 1980s to set up an "international genebank" headquartered in Rome, Mexican scientists in charge of the country's most significant crop collections labored with limited resources to keep these alive and usable in Mexico. In this realm, the same North-South exchanges deplored by Mexican delegates to the FAO often provided the only means for ensuring the continuity of collections and their availability to Mexican scientists. High-level consultations in Rome therefore necessitated new forms of cross-border negotiation and collaboration among scientists.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 20th century, late |
Conservation, environmental science,
transnationalism, localism

Many Shades of "Race": Variations in the Concept of Race in French Sero- Anthropology between the 1940s and the 1970s

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In this presentation, I will study the transformations of the concept of "race" in French sero-anthropology between the 1940s and 1970s, focusing in particular on the work of Jacques Ruffié and his collaborators, at the Centre d'hématologie of the French National Centre for Scientific Research (CNRS). I will show that, far from being abandoned after World War 2, the concept was still widely used by scholars working at the crossroads of anthropology, blood-typing and genetics. It remained an object of numerous investigations undertaken, all over the world, by institutions such as the Centre d'hématologie, both to determine the blood signature of different racial groups, and to study their admixture and filiations. I will explore the many continuities between these research programs and the concept of race as (re)defined by geneticists and blood typing experts in the 1920s and 1930s, while pointing at other, less obvious, affinities

between “hemotypological research” and the older anthropological conception of race. Finally, I will analyze the evolution in the conceptualization of human variability by sero-anthropologists, in the late 1960s and early 1970s, and show that their growing interests in the internal diversity of human populations was not altogether deprived of ambiguities.

Biology | Europe | 20th century, late | race, physical anthropology, genetics

Maoist “Mass Science” and Participatory Action Research: A Case Study in the Global History of Participatory Knowledge-Making

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University of Massachusetts Amherst

Today in China publicly minded social scientists are enthusiastically employing the methods of participatory action research, a form of engaged scholarship most famously associated with Brazilian philosopher of education Paulo Freire. Chinese social scientists typically treat participatory action research as a refreshing foreign paradigm that became accessible to China with the increasing academic exchanges made possible during the post-Mao Reform Era. However, anyone familiar with the discourse

and practices of Mao-era science will recognize the profound similarities between the “mass science” of socialist China and participatory action research. And, indeed, participatory action research emerged during the 1960s and 1970s, when radical intellectuals around the world were studying the epistemological writings of Mao Zedong. This paper will explore the movement of ideas about participatory knowledge-making between China and other parts of the world during the twentieth and twenty-first centuries. As such it represents one step in the process of mapping—across temporal, geographical, ideological, and geopolitical boundaries—the larger global-historical context within which “citizen science” and other understandings of popular knowledge production have gained significance.

Aspects of Scientific Practice/Organization | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general

Mapping and the Microscope

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“We are come ashore into a new World,” declared Nehemiah Grew in

the dedication to his 17th century publication commissioned by the Royal Society. The world he went on to describe, however, did not include any of the typical features one might expect from a treatise on the exploration of new territory. There were no coastlines there – no mountainous regions, no lakes or valleys. Instead, the place he described consisted of roots, seeds, vessels and membranes. Nehemiah Grew was one of the earliest people to conduct a detailed exploration of plant life with the use of a microscope. The things he discovered had he had no language to describe. In the presentation of his research, Grew borrowed freely from other knowledge systems in development at that time, including bookbinding, the study of animal anatomy and his own vitalist metaphysics. One of the most striking features of how he framed his research was in the language of territorial expansion. Grew's reference to the imperialist project was more than simply a rhetorical appeal by Grew; rather it was central to both the discursive and visual language he developed around his work. The engravings that accompanied Grew's publications were necessarily abstract,

resembling less the tradition of botanical illustration than a series of maps or mathematical diagrams. I will trace the visual form of Grew's illustrations through the tradition of cartography and consider the implications of this way of imagining the microscopic world geographically – as a place to be surveyed and conquered.

Thematic Approaches to the Study of Science | Europe | 17th century | microscopy, art history, visual epistemology

Material Traces of Faraway Places: Specimens from Colonial New Spain in Madrid's National Museum of Natural Sciences

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Stanford University

On April 27, 1790, the first natural history museum in New Spain—Spanish territory from California to Guatemala—opened its doors. Its founder, José Longinos Martínez, had arrived in the Americas in 1787 as the taxidermist for the Royal Botanical Expedition, one small part of an immense national scientific undertaking by the Spanish government. While Longinos dedicated his museum to the new king, Charles IV, he established this institution in defiance of the Crown, which had demanded that all natural objects of interest be sent to Madrid.

The former King Charles III had sent off scientific expeditions to gather the wonders of nature from his vast empire while simultaneously ordering colonial subjects in the Americas to send anything similar that they found to the court in Europe. Longinos took care to send back some specimens to the Royal Cabinet of Natural History so as not to arouse too much suspicion. Over the centuries, these specimens have become nearly invisible among the countless other animals, plants, and minerals that made the journey across the Atlantic. Drawing on collections-based, museological research in the Royal Cabinet's modern incarnation, the National Museum of Natural Sciences, this paper will uncover the traces of objects that Longinos sent to Madrid which still survive today. When compared to similar remnants of Longinos's collection in Mexico City, these difficult-to-find traces in Madrid elucidate what was unique to the rise of 18th-century public natural history collections in Madrid versus New Spain, although both

sourced from the same natural materials.

Thematic Approaches to the Study of Science | Global or Multilocational | 18th century | Spain, Spanish Empire, Latin America, collecting, collections, museums, natural history, New Spain

Materiality in the Wild: A Posthumanist Approach to Indigenous Knowledge of West African Wild Silk

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This paper studies conceptions of Indigenous knowledge-based material practice in the trade, production and use of wild silk within a posthumanist theoretical framework (Barad 2007). By focusing on actual conceptions of its material and symbolic agency, affinities and affordances, it inquires about the silk's materiality that helps to inform about an Indigenous science of materials that entangles knowledge, technical and belief systems. Wild silk that is produced by silkworms of genus *Epanaphe* or *Anaphe* has been for centuries locally harvested in the forests and the Sahelo-Sudanian areas of Nigeria and throughout West Africa. In the Hausa region of Northern Nigeria, indigenous silk that is

considered as a material of prestige, has been mainly used in hand embroidery, produced on traditional male robes known as babban riga (Kriger 2010). On these garments, silk patterns that remind of Islamic calligraphy enact as a form of talismanic magic that protect against the evil eye and confer charisma to the wearer. By using travelers' accounts, colonial reports, museum collections and oral tradition recorded through systematic ethnographic interviews, this paper looks at aspects of Indigenous conceptions about the material, cultural and historical significance of wild silk, starting from the 19th century Sokoto Caliphate located in Northern Nigeria until the contemporary period. Framed within a historical and anthropological approach to materials, the paper's posthuman focus lies in the examination of silk's material qualities and properties that include intertwined medicinal and magical values for which this elusive insect material has been praised across West Africa.

Social Sciences | Africa | 19th century | Indigenous sciences - materials - wild silk techniques - knowledge and belief systems - history - anthropology - embroidery and textile - talismanic magic - agency - posthumanism.

Materials of the Mind: Phrenology, Correspondence, and the Global History of Science, 1815-1920

James Poskett
University of Warwick

In 1828, the Edinburgh phrenologist George Combe (1788-1858) published his now famous work, *The Constitution of Man*. Over the course of the nineteenth century, this book sold more than 300,000 copies, and was translated into at least six different languages, including Bengali and Japanese. From American senators to Indian social reformers, phrenology soon found supporters stretching across the globe. These individuals were bound together by the increasingly globalised postal networks of the nineteenth century. In this paper, I explore how phrenologists used the postal service to build a global movement. In doing so, I focus particularly on the materiality of these networks along with the objects that were sent alongside letters. These objects include skulls collected in the Arctic, plaster busts manufactured in Paris, and phrenological charts printed in Bengal. This focus on materiality also allows me to explore the limits of phrenology as a global scientific

movement, suggesting the ways in which particular people and regions were cut out of the story. More broadly, this paper suggests how the global history of science can be written through the global history of material culture. In the nineteenth century, what it meant to be a global science of the mind was in part a product of global material exchange.

Aspects of Scientific Practice/Organization | Global or Multilocal | 19th century | Global History, Phrenology, Mind, Letters, Race, Reform, Politics

Mathematical Skills and Household Service in the Career of Sébastien Le Clerc

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Tel Aviv University

Sébastien Le Clerc (1637-1714), one of the most successful engravers of Louis XIV's France, was born to a family of goldsmiths in Lorraine, and received classical artisanal training. Yet over the course of a highly successful career as an engraver, he also became a widely published scientific author. His publications ranged from topics commensurate with artists' interest, such as perspective and optics, to publications on cosmology, far removed from the workshop. This paper argues that mathematical skills played a key role in the dual

development of Le Clerc's career, who simultaneously became an engraver and strove to recognition as a man of letters and natural philosopher. Yet these mathematical skills only came fruition in the context of household service, in particular as an education to the children of Jean-Baptiste Colbert, the powerful minister who spearheaded the transformation of the French cultural sphere in the 1660s. By tracing Le Clerc's dual career arch, and showing how mathematical skills served to integrate Le Clerc into several contexts, from the Colbert's household, through the world of publishing and the royal manufactures at the Gobelins, this paper seeks to revisit the thorny question of the relations between scholars and artisans during the Scientific Revolution. Rather than relying on hands-on, bodily experience, it was Le Clerc's skill in mathematics that lend support to his aspiring scholarly career. These skills were published and advertised though his connections to powerful houses, which connected the developing state bureaucracy and

manufactures with the market for scientific books.

Aspects of Scientific Practice/Organization | Europe | 17th century | Mathematics, art, artisans, skills, household, Gobelins, Colbert, Le Clerc, France, Paris

Matter as Epistemic Object: Intellection, Manipulation, and Particularisation in the 13th Century

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The paper explores the richness of scientific and philosophical approaches to matter in the thirteenth century. The twelfth-century Arabic- and Greek-into-Latin translation movements provided, in a relatively short time, a Latin audience with different accounts of matter as epistemic object proper to diverse disciplines—natural philosophy, logic, metaphysics, as well as alchemy, medicine, and astronomy. I will discuss tensions and implications arising from a consideration of such a plurality of meanings and theories of matter and materiality in the thirteenth century.

Physical Sciences | Europe | Medieval | Astrology, cosmology,

Matthias Schleiden's Theory of History

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University of Wisconsin-Madison

In 1851, the botanist and cell-theorist Matthias Schleiden wrote a remarkable essay. In part a book review of Karl Vogt's German translation of Vestiges of the Natural History of Creation, it ranged much further, to present an explanation of the contemporary vogue for popular science. Schleiden's explanation was historical. From this essay and others, I piece together Schleiden's theory of history, which viewed cultural change as the result of a very few, very great men whose ideas would take centuries to filter out into the broader public. I argue that this theory of history, which included the history of natural science and its popularization, helps us to see how he viewed his own role in the historical process and, by implication, the role he saw for his own works of botanical popularization. Ultimately, I suggest, understanding Schleiden's view of history allows us to interpret

his larger body of work in a new and more integrated way.

Thematic Approaches to the Study of Science | Europe | 19th century | history of botany, theory of history, history of popular science, popularization

Measuring Minds: Boring, Skinner, McGregor, and Stevens, and the Origins of Operationism

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Tilburg University

In 1935, Stanley Smith Stevens published two articles in which he urged for a revolution in psychology. Building on P.W. Bridgman's methodological prescriptions for physicists, Stevens argued that all psychological concepts need to be strictly defined in terms of public operations. If psychology is to be taken seriously as a rigorous science, Stevens argued, psychologists have to make sure that they are not talking at cross purposes when they are discussing their theories about 'experience', 'consciousness', and 'sensation', they have to make sure that their concepts are 'operationally defined'. In view of Stevens' success in spreading the operationist message, it is small wonder that he is widely viewed as the intellectual father of psychological operationism. In this paper, however, I argue that Stevens

was not the first scholar to translate Bridgman's conceptual strictures to psychology. I show (1) that Gary Boring and B.F. Skinner had already been applying Bridgman's approach to psychology when Stevens was still an undergraduate student and (2) that Douglas McGregor coined the term 'operationism' before Stevens. Since Boring, Bridgman, McGregor, Skinner, and Stevens were all affiliated with Harvard in the early 1930s, the question arises what role these scholars played in the development of psychological operationism. In this paper, I answer this question by examining a large set of documents from the Harvard University Archives. Instead of taking Stevens' papers as the *starting point* of the operationist turn, I reconstruct the intellectual climate at Harvard in the years leading up to the publication of the operationist manifestos.

Medicine and Health | North America | 20th century, early | Operationism, psychology, logical positivism, Stanley Smith Stevens, Gary Boring, B. F. Skinner, P. W. Bridgman, Douglas McGregor

Measuring the Mind: Replication in Early Psychological Experimentation (1890-1925)

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My talk starts with some general definition of the term “replication” and remarks on the historiography about experimentation, recalling the discussion about this feature of scientific practice in the works of Shapin & Schaffer; Collins, Galison, etc. But in these works, no mention is made on how psychologists became concerned and used replication. Already Kant, who examined the possibility of psychology becoming a real science, had mentioned as one obstacle the non-replicability of psychological introspection. Therefore, for Wundt and his colleagues the demonstration of psychological experiments being replicated was crucial. In my talk, I will a) expose views on replication and replicability expressed by leading psychologists such as Wundt, Titchener, Watson and Dunlap; b) offer examples and compare how this tool was used in some empirical studies in connection with psychological methods (e.g. introspection, association experiments and mental testing), and c) examine the role replication

played in controversies of the time. The examination of historical sources shows what scientists in the past understood by “replication” and why they thought that this should be part of the process of knowledge construction. I conclude that replication gained historical prominence, as soon as the main objective of psychological research was to identify laws. In general, it seems that the debates about replication deepened consciousness of psychologists about problematic aspects of psychological experimentation (in general), influencing the standards of scientific research.

Aspects of Scientific Practice/Organization | Europe | 20th century, early | Mind, Introspection, Experimentation, Repetition, Scientific Debates, Psychology

Mechanization by Insect: Multi-Species Ecologies in the Malaysian Plantationocene

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This paper explores the human-assisted transoceanic migration and resettlement of the African Palm Weevil in Malaysia and S.E. Asia, and the consequent environmental and social upheaval that emerged at the intersection of biological

symbiosis, neocolonial labor policies, accelerating economic change, and biodiversity heritage. In the 1960s and 70s, as Malaysia was transitioning away from rubber plantations and towards palm oil, British planters conjectured that yields were lower in SE Asia than in the palm's native West Africa due to the absence of a native pollinator. Funded by Unilever, a Pakistani entomologist, R.A. Syed, traveled to Cameroon and received permission from the Malaysian government to import African Palm Weevils, which he had discovered to be obligate pollinators and symbiotes of oil palm. Within a few years of the insects' release, Malaysian palm oil production became both more efficient and economically dominant, and deforestation and biodiversity loss accelerated. The predominantly female human labor force who had been hand-pollinating the palms before found their jobs replaced by an insect, in what can be alternately viewed as a form of biotechnological automation or an alteration of the plantation ecosystem.

Biology | Global or Multilocational | 20th century, late | Entomology, Malaysia, Cameroon, agriculture

Medical Mapping, Burkitt's Lymphoma, and the East African Virus Research Institute, 1962-1979

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The discovery of Burkitt's lymphoma (BL), a childhood cancer that appeared to be limited to particular parts of Africa and caused by a virus, attracted a range of researchers with a stake in the field of cancer viruses to Uganda. Between 1962 and 1979, the East African Virus Research Institute (EAVRI), a laboratory founded in Entebbe in 1936, conducted a series of investigations into the etiology of the lymphoma. This research took place in a period of intense change at the Institute and in Uganda in general, coinciding with the advent of national independence, the first administration of a Ugandan president, and the rise and fall of Idi Amin. These changes cast uncertainty onto the future of the EAVRI. Drawing on oral histories, archives, and published material, this paper examines the cartographic practices of the EAVRI's research on BL, both in the preliminary exploratory stage and in the later cohort study. These investigations offer a window into the use of

medical maps to configure independent Uganda as a valuable site of medical research and to tease out the relationship between cancer, a putative infectious agent, and the natural and social environment. This story sheds light on the negotiation of the roles of EAVRI's African and expatriate researchers, international visiting scientists, the study populations in West Nile, Uganda, missionaries, government officials, and a wide array of intermediaries. It also highlights the ways that scientists in Uganda invested in strategies that would facilitate new research programs in the post-colonial period.

Medicine and Health | Africa | 20th century, late
| medical maps, Burkitt's lymphoma, natural
and social environment, Uganda

Medical Practices in Early 20th Century São Tomé's Cocoa Plantations

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This paper aims to discuss the medical practices in the cocoa plantations of São Tomé, a Portuguese colony in the Gulf of Guinea. As in other contexts, São Tomé's plantations were dependent on large contingents of displaced black laborers, framed by different institutions from slavery to

indentureship. When in the early 1900s the territory became the world's most important cocoa producer, local mortality rates reached 20% and the island's coercive and deadly labour system caught international attention. By then, white physicians came to occupy a prominent position. Framing plantations as specific repertoires of imperial power, this text argues that those experts were important actors in the maintenance of its racial politics of difference. Attributing the persistence of and susceptibility to diseases to degenerated black bodies and black cultures became a common trope. Physicians established a correlation between specific diseases, such as pneumonia and dysentery, and black's "immoderate habits", such as alcoholism and dirt eating. Also "nostalgia for the motherland" was framed as a pathological condition leading to suicide. Medical authority over what were conceived as racial constituted diseases, deviant behaviors and psychological weakness demanded institutions and spaces of surveillance and confinement. Along with hospitals, the redesign of plantation housing quarters became part of these professionals tasks. As such, I will

try to show how physicians brought together a focus on bodies and on the plantation built environment, connecting racialized biological and spatial practices in a single narrative.

Medicine and Health | Africa | 20th century, early | Indentured Labor, History of the Body, Scientific Racism, Tropical Medicine, Science and the Built Environment, Science and Medicine in the Portuguese Empire

Medicalizing Religion: Christian Science as a Historical Cause of Madness

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At the turn of the twentieth century, hundreds of Christian Scientists, including their founder Mary Baker Eddy, were charged with insanity owing to their religion. As a new religion, Christian Science became part of the medically-sanctioned etiology of insanity at the time. Newspapers were swift to pathologize Eddy and the members of her church thus justifying their institutionalization. Their stories were manufactured into tabloid sensations that depicted Christian Scientists in a variety of denigrating frameworks such as murderer, family-disrupter, and subverter of gender roles. Superintendents of insane asylums served as expert witnesses in trials where they were

utilized by both the defense and prosecution to demonstrate the scientific credibility of belief in Christian Science as a precipitator of insanity. The proposed paper examines how turn of the century American politics of religion and medical science intertwined to construct Christian Science as a cause of insanity. I draw not only from medical sources such as scientific journals and medical conference proceedings, but popular coverage of emerging tropes of madness in connection with religion. To focus my discussion, I employ historical media coverage of two trials in which Christian Scientist defendants were adjudged both sane and insane by physicians. In both of these cases, the female defendant's mental capacity was questioned owing to their religious identity. I argue that historical charges of insanity levied against members of Christian Science reveal complex tensions concerning the historical negotiation of faith within medical discourse.

Medicine and Health | North America | 20th century, early | psychiatry, religion, Christian Science, medical science

Medicine, Method, and Metaphysics: Tradition and Innovation in Descartes' Medical Works from the Writing of L'Homme to Its Posthumous Publications

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In this paper, I will address three related topics: (1) I will discuss Descartes' medical sources and aims when he was writing the long eighteenth chapter of *Le Monde* (The World), devoted to the study of *L'Homme* (Man) in the early 1630s. (2) I will demonstrate the significant novelty introduced in the fifth part of the *Discourse on Method* (1637), where the link between method and medicine was rethought, as well as the relationship between medicine and metaphysics, especially in comparison to Harvey's treatise *On the movement of the heart and blood* (*De motu cordis et sanguinis in animalibus*). I will also discuss Descartes' influence in medicine especially through Henricus Regius' medical teaching in Utrecht. (3) I will highlight the primacy given to medicine in the *Passions of the Soul* (1649), the last book published by Descartes, after the *Meditations*, *Objections and Replies* and the *Principles*. I will

show its links with *La Description du corps humain* (The Description of the Human Body). Finally, I will explore the relevance of the publication of the *Treatise on Man* together with *La Description du corps humain* in 1664 in Paris by Clerselier with *Remarks* by Louis de La Forge, a physician, after the Latin version of the *De Homine* published in 1662 in Leiden by Schuyl.

Thematic Approaches to the Study of Science | Europe | 17th century | Aristotle, Vesalius, Bauhin, Descartes, Harvey, Regius, Schuyl, Louis La Forge, medicine, method, metaphysics, study of man, principle of life, soul, heart, blood, animal spirits, movements in the body, tradition, innovation

Meet the Elite: Nobel Symposia and Scientific Exclusivity

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In the postwar era scientific conferences became ubiquitous and increasingly very large. As a reaction to this development, the Nobel Foundation in 1965 instituted the self-consciously elitist Nobel Symposia, still a going concern with around 160 meetings organized so far. The areas covered by the Nobel Symposia have mainly been those represented by the Nobel Prizes, including the prize in economic science founded in 1969. But issues

of broader intellectual and social significance have sometimes been in focus as well. Using a frontstage-backstage approach this paper will examine the origins of the symposia – how they were conceived from a scientific as well as a political perspective, how support for the project was established nationally and internationally, and how the first symposia were organized and staged. A central question is that of exclusivity, how the symposia were imagined and staged as platforms for elite science and as a breeding ground for future elites. Particular attention will be paid to the 1969 symposium on “The place of values in a world of facts” which constituted the first but not the last example of how the symposia were used to stage more broadly conceived elite summits grappling with issues seen as important from the perspective of global development.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 20th century, late |
Nobel Symposia, elite science, societal
relevance

Meeting Nature Halfway: Georg Forster, Mining, and Aesthetics of Artifice, 1784

Patrick Anthony
Vanderbilt University

In 1784, Georg Forster traveled through mining-landscapes in Germany’s Harz and Ore Mountains--a journey long neglected in favor of his more glamorous globe-trotting with Captain Cook. But it was in these industrial landscapes that Forster encountered “a new and rejuvenated Nature.” Descending shafts, inspecting weirs, and studying smelting ovens, Forster came to see water- and horse-powered industry as a noble human effort to participate in the “workshop of Nature.” His journals oscillate between hubris and humility: keenly aware of the awesome power of nature evidenced by mine collapses, Forster understood mining as a project of “fitting,” even “completing,” natural landscapes. Following Forster, this talk elucidates the unfamiliar sentimental world of late-eighteenth-century resource extraction, which beguiles two dichotomous historiographical traditions. While some scholars describe the extractive ethos of Forster’s generation as a wholesale

“oeconomization of nature,” another tradition identifies this period, with its embrace of holism, as a wellspring of ecological thinking. The curious nature of this moment is captured by the fact that so many romantic figures participated in Germany’s mining industry—from poets like Goethe and Novalis to savants like Henrik Steffens and Alexander von Humboldt. Forster, to whom Humboldt attributed his own holism, helps us engage the alterity of a worldview whereby dominion over nature was to be “shared with nature.” To that end, this talk grounds the lofty aesthetic meditations of Forster and his contemporaries in the “working world” of mining, specifically in the hydraulic systems that epitomized their philosophy of nature.

Earth and Environmental Sciences | Europe | 18th century | travel, environment, sustainability, resources, waste, discard, mining, landscape, aesthetics

Mendeleev's Periodic System of Elements and Croatian Academy of Sciences and Arts

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The reception of the periodic system of elements in European countries

has its specificity and differences. This paper will explore the first recognition of the periodic system of elements in Croatia after its publication (1869). Croatia was then a part of the Kingdom of Croatia, Slavonia, and Dalmatia within Austria-Hungary. Chronologically, Croatian scientific community firstly recognized Mendeleev's work through Yugoslav Academy of Sciences and Arts in 1882, electing him as its honorary member. The proposal for Mendeleev's election lists his published works but emphasizes that the discovery of the periodic system of elements (lex Mendeleev) alone would be enough to elect him as an honorary member. Thus, the Yugoslav Academy of Sciences and Arts became the first European science academy to honor Mendeleev. Circumstances regarding this election will be presented in the paper. Until the University in Zagreb, capital of Croatia, was restored (1874), chemistry in Croatia was only thought at a lower level, as a part of real-high schools curriculum. The discovery of the periodic system of elements and the following discoveries that lead to its confirmation occurs simultaneously with the development of the

chemistry curriculum at Zagreb University. The first University professors were also the members of Yugoslav Academy of Sciences and Arts that elected Mendeleev as its honorary member. The connection between the role of the Academy of Sciences and Arts and the implementation of the periodic system in the educational process in Croatia will also be explored in the paper.

Chemistry | Europe | 19th century | reception of the periodic system of elements, development of chemistry education in Croatia, Croatian Academy of Sciences and Arts, Dmitri I. Mendeleev

Michael Coignet: A Mathematical Practitioner in 16th Century Antwerp

Ad Meskens

AP University College, Antwerp

Around 1550 Antwerp was a vibrant port. Its many schools catered for the many companies, its Beurs was one of the first stock markets of the world, its printers published books on all subjects. Ships travelled to all parts of Europe, the Baltic, Italy, Scotland, the Azores with merchants dreaming of sailing even further. This optimistic view was shattered by the Iconoclastic Revolt of 1566 and the intransigence of Philip II to make concessions to the protestants.

First and foremost among Antwerp's mathematicians was Michiel Coignet, schoolmaster, winegauge, instrument maker and mathematician to the Archdukes. From the 1570s onwards he kept notes on a variety of mathematical subjects. Parts of these notes written between 1576 and 1603 are preserved in the Bibliothèque Nationale in Paris (Ms Néer 56, Est de Michaelis Coigneti 1576). They give an insight not only in mathematical developments but also in some sociological changes. The manuscript shows the relation between pure and applied mathematics. In this talk we will address these topics.

Mathematics | Europe | Renaissance | Low Countries, Antwerp, mathematical practitioners, Coignet, winegauge, instrument-maker

Missing Link: Nikolai Vavilov's Genogeography and History's Past Future

Elena Aronova

University of California, Santa Barbara

In the historical memory of the twentieth century science the figure of the Soviet biologist Nikolai Vavilov looms large. Here, I tell a less familiar story, one that reveals how Vavilov's genetic geography research has become entangled with the beginnings of the Annales school

of historiography. The congruence of Vavilov's scientific interests and the Bolsheviks' political interests not only enabled Vavilov's ambitious program but also made Vavilov's work widely known across national, linguistic, political and disciplinary boundaries.

Vavilov's work on the centers of origin of plant genetic diversity shed light on the prehistory of human settlements in such understudied regions as Afghanistan and Vavilov himself explicated the implications of his research for the way historians came to think about deep past at such occasions as the Second International Congress for the History of Science and Technology in London in 1931. In the 1930s, the historians associated with the *Annales*, such as Lucien Febvre, followed Vavilov's work closely and drew inspiration from Vavilov's insights into human prehistory. Vavilov, in turn, not only bridged biology and history in his work but also served as a crucial link between biologists in the Soviet Union and the historians in France. These cross-disciplinary connections have been lost in the disciplinary memories of both biology and those of the historiography. Recovering this "missing link," the paper will

reconstruct the many worlds Vavilov inhabited, and ways in which the epistemologies, material cultures and political agendas of his project were closely intertwined and reinforced each other.

Biology | Central Asia | 20th century, early

Mistress of the Sciences, Asylum of Liberty: Science, Human Rights, and Freedom from the 1790s to the 1970s

Paul Rubinson
Bridgewater State University

In 1794, several persecuted scientists, most notably the chemist Joseph Priestley, fled England for asylum in the United States. Americans celebrated Priestley's arrival as a victory for science, human rights, and freedom, while their leaders hoped refugee scientists would enhance national science and security. Thomas Jefferson, seeing science as crucial to international prestige and imperial ambitions, used Priestley's presence to define American conceptions of freedom and human rights as fundamental to the scientific discipline. By declaring the United States the best, freest place to practice science, Jefferson began to realign the internationalism of science according to U.S. interests, ideology

and national development. In the 1970s, U.S. scientists again rallied to protect human rights, endeavoring to rescue Soviet scientists from persecution, in particular the physicist Andrei Sakharov. The rhetoric of human rights that U.S. scientists used to support Sakharov was almost identical to the language used in support of Priestley two hundred years earlier. Science was again deemed impossible without the U.S. conceptions of freedom and human rights, and the United States again posited as the ideal place to practice science. By this point, however, the United States had become the scientific juggernaut envisioned by Jefferson, with U.S. institutions producing hundreds of Nobel Prize winners. This paper examines the long interaction of U.S. scientists with human rights movements and the political, scientific, and ideological consequences of turning the United States into what Jeremy Belknap in 1780 called “the Mistress of the Sciences, as well as the Asylum of Liberty.”

Thematic Approaches to the Study of Science |
Global or Multilocal | 20th century, late

Model Communities: Artificial Anatomies and the Paradox of Modern Identity

Anna Maerker
King's College London

Using case studies of nineteenth-century anatomical model making and use, this paper seeks to challenge/interrogate current historiography concerning the role of anatomical representations for modernity. Following particular readings of Foucault’s concept of power/knowledge, historians’ interpretations of anatomical images and models tend to foreground these objects’ functions as representations of a distinctly modern body: healthy, productive, and individual, and in need of constant vigilance, maintenance, and self-improvement. Gendered and racialised representations were used to claim functional and hierarchical differences between the sexes and races. However, cases of anatomical model use indicate that models were simultaneously employed in efforts to create new kinds of communities through processes of emulation and education, from women’s rights activists in the U.S. to workers’ communities in France and new groups of medical practitioners in Egypt. The paper will use these

examples to explore how tensions between individuality and shared identity were articulated around anatomical models, and ask how we can tell stories about such medical objects which acknowledge their oppressive, isolating function while also recovering their potential for the constitution/creation of new types of communities.

Medicine and Health | Global or Multilocational | 19th century | material cultures, medical artifacts, anatomical models

Modelling Authority: Obstetrical Machines, the Senses, and the Boundaries of Expertise

Jennifer Kosmin
Bucknell University

The public display of wax anatomical models in eighteenth-century Italy attracted Grand Tourists and was intended to contribute to the Enlightenment project of cultivating virtue and the public good. Not all anatomical models were destined for wide public consumption, however. This paper examines obstetrical machines used in the instruction of midwives and surgeons to demonstrate the distinctive concerns regarding authority and expertise they embodied. If anatomical models available for public display aimed at enlightening audiences with

valuable knowledge about their own bodies, obstetrical machines and models incorporated into medical training functioned to demarcate boundaries of knowledge and render the female reproductive body necessary of management by those with a specialized medical knowledge. Obstetrical machines also became a site of negotiation regarding the nature of knowledge and the sources of expertise. While male practitioners interested in childbirth had typically emphasized their theoretical and anatomical knowledge to demonstrate their superiority to midwives, obstetrical machines encouraged the cultivation of touch as much as sight for the successful management of childbirth. In Bologna, the obstetrics instructor Giovanni Antonio Galli famously blindfolded his students before they practiced maneuvers on a machine. Critics, however, tended to focus on the machines' lack of naturalism. Mechanically contracting uteri and fabric fetal dolls, they argued, could not mimic the true sensations of childbirth. This paper uses obstetrical machines as a lens through which to consider eighteenth-century debates on the boundaries of expertise, the importance of touch in medical

practice, and the lines between nature and artifice.

Medicine and Health | Europe | 18th century | anatomy, expertise, the senses, obstetrics, obstetrical machines, wax models

Monster Collectors from Peter to Willem: Abnormal Bodies and Embryology, 1697-1849

Sara Ray

University of Pennsylvania

The Dutch anatomist Willem Vrolik collected several hundred abnormal human fetuses over the first half of the nineteenth century. Vrolik was one of the early teratologists, scientific men who sought to classify types of bodily abnormality and, through classification, discern what caused them. Vrolik created a museum showing that “monstrous bodies” appeared throughout the animal kingdom in regular morphological types that, he claimed, were produced when the normative workings of an immaterial force called *vormkracht* were disrupted. Vrolik’s collection and classification of abnormal fetuses followed a century of scientific dispute about the processes of generation. The belief that collecting, anatomizing, and comparing “monstrous bodies” might reveal their natural causes was first put forth by the Russian Tsar

Peter the Great after he learned new techniques of anatomical preservation during his 1697 visit to Amsterdam. Upon returning to Russia, Peter issued a royal order that all monstrous births-- human and animal, alive and dead-- should be sent to him for preservation. It was Peter’s “storehouse of monsters” that Caspar Wolff used later in the century to bolster his theory of epigenetic embryological development. Beginning with Peter’s monster collecting and ending with Vrolik’s teratological museum, this paper examines how preservations of “monstrous births” offered materialized epistemological tools for naturalists attempting to unravel the mysteries of embryological development. While “wet” preservations were new in Peter’s time, they had become a central part of anatomy collections by Vrolik’s. I argue that this shift in material evidence was crucial to the epigenetic turn in embryology.

Biology | Europe | 18th century | teratology, monsters, anatomy, anatomical collecting, museum, Russia, the Netherlands, embryology, abnormality

Monstrous Births in Medieval Jewish Philosophy

Marienza Benedetto
University of Bari (Italy)

My paper engages with a rather specific and yet understudied case of natural irregularity: the phenomenon of monstrous births within the Medieval Jewish tradition. How did Premodern Jewish scientists and philosophers consider bodily defects that were evidently disagreeing with the regularity of Nature? What kind of justifications – if any – did Medieval Jewish thinkers provide in order to explain this particular phenomenon in its manifold expressions? Indeed, different theoretical justifications to the incidental irregularity of nature appear to have implied different practices to amend the corporeal exceptionalities of this kind of bodies. But what these practical measures were? And could they actually be implemented? My paper will discuss these central points, focusing in particular on the crucial contribution offered by Moses ben Maimon (Maimonides, c. 1134 – 1204) in his medical works.

Medicine and Health | Near and Middle East |
Medieval | Monsters, irregularity, Maimonides

More Than Just Poop: Guano in Late 19th and Early 20th Century China

Sijia Cheng
Universität Heidelberg

This paper investigates how the Chinese started to know about the agricultural value of guano and search for their own potential guano islands in late 19th and early 20th Century. Since the early nineteenth century, because of its nitrate-rich quality, guano has been recognized by chemists worldwide as the finest fertilizer. It became a highly valuable resource and hot commodity desired and harvested by Western and Japanese powers. Since the second half of the nineteenth century, many Chinese intellectuals also realized the value of guano as an effective fertilizer through Western books. They started to regard it as the best fertilizer, even more valuable than human and animal manure, which had been applied to enrich the soil fertility in China for centuries. Two opposite opinions towards this previously unknown resource emerged. One acknowledged the unavailability of guano due to the lack of seabirds' islands and suggested to look for other alternative manure. Based on their understandings of chemical

knowledge, many Chinese intellectuals started to argue for suitable manure that contain vital elements (such as nitrogen and phosphorus). The other opinion urged the Qing government to defend the territorial sovereignty of some islands near Kanton from the Japanese occupation and reclaim the exploitation right of guano back. As the second opinion developed, rather than its agricultural value, bird excrement mattered greatly due to its economic and geopolitical significance. By looking at the fate of guano in China, this paper aims to shed some light on the entwined relations between knowledge of animals and social, economic and political power.

Earth and Environmental Sciences | East Asia | 20th century, early | animal waste, human and animal manure, agriculture, geopolitical power

Morphine Dreams: Auguste Laurent and the Active Principles of Organized Matter

Theresa Levitt
University of Mississippi

In the 1840s, the French chemist Auguste Laurent turned to the study of the “active principles” of alkaloids, which ranged from the medicinal properties of quinine and cinchonine, to the deadly poison of strychnine, to the intoxicating

effects of morphine and nicotine. Laurent had recently returned from working with August Hofmann in Giessen, and soon after began using aniline to synthesize his own, artificial alkaloids. On hearing this, the physicist Jean-Baptiste Biot then approached him to compare the optical properties of his artificial alkaloids to the natural ones. Working with Biot and Apollinaire Bouchardat, the head pharmacist at the Hotel-Dieu, they found that while all the natural alkaloids deviated the plane of polarization of light, or were optically active, the artificial ones were not. Informed by earlier debates about the optical activity of sugar, and whether its conversion into alcohol was a chemical or biological process, they emphasized their results indicated a level of organization that went beyond chemical composition. This paper explores the way that Laurent, Biot and Bouchardat mobilized the concepts of activity and organization to explore the ability of plants to affect the body and maintain a distinction between natural and artificial compounds in the post-vitalist landscape. It also addresses the contextual factors suppressing these views in the chemical community, the use Pasteur made of

them uniting his work on fermentation and crystallography, and his subsequent efforts to deemphasize his association with Laurent.

Chemistry | Europe | 19th century | alkaloid, optical activity, Laurent, Biot, Pasteur

Moving on the Wall: Performing Organisms with the Solar Microscope

Janina Wellmann

Leuphana Universität Lüneburg

Unlike the classical microscope, the solar microscope produces its image not in the eye of an individual beholder, but on the wall of a curtained room. Surrounded by darkness, the sun's light illuminates the greatly magnified image of tiny objects or objects invisible to the naked eye. During the Enlightenment, solar microscopes were enormously popular, and fulfilled the ideal of a useful pastime and a gentlemen's science. For a long time, the history of science largely disregarded eighteenth-century microscopy, and the solar microscope appeared scientifically marginal—at most a kind of toy. In my paper, I address an aspect of solar microscopy that has attracted virtually no attention in the history of biology: the experience of a world

in motion. Scholarship on the image-world of solar microscopy has hitherto focused almost entirely on the copper plates accompanying the microscopy books of the eighteenth century. Instead, I will argue that the experience of motion is the specific sensory experience of the microscopic world that only the solar microscope could offer and that lies at the very heart of the instrument's performance.

Biology | Europe | 18th century | visual representation, pre-cinema history, performativity, animate motion

Moving Pictures in Class: The Audiovisual Heritage of Gdr Educational Films on Science

Kerrin Klinger

Bibliothek für Bildungsgeschichtliche Forschung (BBF) im Deutschen Institut für Internationale Pädagogische Forschung (DIPF)

Classroom films have certain aesthetic and didactic characteristics, and they are linked to specific conditions and practices of education within a political system. In the GDR, nearly every child was confronted with a certain audiovisual culture, its specific rhetoric and its visual 'pathos formula' in school transmitted by teaching aids. Educational films were explicitly appreciated as particularly affect-

oriented teaching materials. Thus, beyond the mere conveyance of specialized knowledge, the educational films were used to influence attitudes and transmit positions towards aspects of knowledge. While educational films from the former West Germany are stored in the Leibniz Information Centre for Science and Technology University Library (TIB) and accessible through an online portal, this is not so much the case for the Eastern German educational films. The GDR audiovisual heritage is held by the Federal Archive, but it is hardly inventoried. Here only The Wende Museum in Los Angeles, US, provides their digitalized collection on GDR films. In this contribution I will examine how historical classroom films visualize and document historically predominant images of science as well as self-interpretations of a society, but also the filmmakers' conceptions of the target audience, the teachers and learners. This is only possible by looking at film collections as a whole, rather than focusing on singular films. The presentation focuses on 16mm educational films on science in the GDR and FRG and questions the purpose of moving pictures as an

educational tool as well as a historical resource.

Tools for Historians of Science | Europe | 20th century, late | film history of the GDR, archive history, audiovisual heritage

Moving Pictures: Sociobiology and Public Persuasion

Cora Stuhmann

Ludwig-Maximilians-Universität München

Understanding the sociobiology debate means understanding how its subject matter was presented to the public. The controversy about sociobiology quickly reached the national stage with publications such as the New York Times and the New York Review of Books providing room for debate and partisan coverage. Sociobiology's fiercest critics Stephen Gould and Richard Lewontin presented sociobiology as yet another iteration of biological determinism to support reactionary politics, while E.O. Wilson stressed Sociobiology's scientific achievements and portrayed himself as the victim of academic vigilantism by political ideologues on the left. This effort by proponents and critics alike to convince the public of their interpretation of sociobiology is exemplified in the history of a 1976 film entitled Sociobiology: Doing what comes

naturally. Hoping to promote the explanatory power, disciplinary coherence and social relevance of sociobiology, three leading Harvard sociobiologists, including Wilson himself, gave interviews to the Canadian television network CTV in March 1972. However, the final product was not suitable to promote Wilson's New Synthesis but instead played into the hands of Wilson's critics. This film became a crucial weapon in their arsenal to convince the public of the true nature of sociobiology as genetic determinism and naïve reductionism. This paper explores the production, reception, and utilization of this film in one of the most public scientific controversies of the 20th century. It argues that sociobiology's critics were successful in their mission to create public controversy, but that sociobiology's actual impact is its immense influence on other disciplines.

Biology | North America | 20th century, late | evolution, evolutionary biology, sociobiology, scientific controversy, science popularization, Science for the Public

Multispecies Choreographies of Animal Experimentation

Anne Van Veen

Descartes Centre, Utrecht University

In this paper, I examine how historical accounts of experimentation on nonhuman animals can be written in a way that does justice to tested animals as agentic and response-able living beings. In accordance with recent calls to decenter the human, nonhuman animals are given center stage, not because they affect human history, but because they are seen as subjects worthy of investigation in their own right. Several scholars have used the term choreography to write about interactions between humans and other animals. I propose multispecies choreography as a useful concept for writing about animal experimentation non-anthropocentrically. Thinking of these practices as multispecies choreographies, draws attention to all animals involved as embodied individuals, interacting within and across species as well as with their shared physical environment. Based on two empirical case studies about experiments on monkeys and mice, it is argued that these interaction often reproduce, but sometimes also challenge species boundaries.

Analyzing how these multispecies choreographies change over time, necessitates examining micro-macro interactions to understand how the worlds of tested nonhuman animals are affected by developments in law, policy, et cetera. Finally, thinking of experimentation practices as choreographies can also show the workings of power, when considering not only movements included in the choreography, but also those movements that are excluded due to constraining species hierarchies within the lab and within wider society.

Thematic Approaches to the Study of Science | Europe | 20th century, late | animals, laboratory, animal experimentation, choreography, anthropocentrism

Narrative and the Textual Configuration of Cases in Late Nineteenth-Century Psychology

Kim Hajek
LSE

How do textual practices function to make sense out of large data sets, when that “data” is not “given,” but rather narrated in extended prose form? Known as “cases,” “observations,” or “facts,” extended textual chunks formed a key currency of the human sciences into the twentieth century. Just how to structure such particularised units in

order to produce generalised knowledge has been the subject of much recent scholarly enquiry. Medical cases might be synthesised into some ideal disease profile, or psychiatric observations ordered through paper technologies like the table. But generalisations of this kind were usually accompanied by (some) of their constituent cases, and often enough, collections of observations almost stood alone—like those added by Hippolyte Bernheim to his major works on (hypnotic) suggestion (1888, 1891). Focusing on emerging scientific psychology in nineteenth-century France, this paper considers individual observations as textual knowledge-making entities in their own right. It explores how narrative form and literary techniques articulate with the way psychological cases were generalised—as series, collections, syntheses. It traces conditions under which narrative elements—range of narrative voices, level of detail, temporal organisation—could work to destabilise the categorisation of a given observation. Conversely, some literary techniques generated larger narrative arcs out of groups of observations, thereby reinforcing the epistemic or ontological weight of

their sequencing, while diversity in narrative form could also hold observations apart. Ultimately, mapping textual practices against knowledge-making functions provides insight into the ways psychological forms of case-writing evolved out of older disciplinary traditions.

Medicine and Health | Europe | 19th century | psychology, narrative, textual practices, generalisation, observation

Nationalizing Science in Republican China: The Birth of China's Policy on Foreign Biological Expeditions

Aijie Shi

University of Wisconsin-Madison

My study addresses the birth of Republican China's policy on transnational biological expeditions, which, I argue, was enacted in response to a Japanese biological expedition along the Yangzi River in 1929. Through the engagement, Academia Sinica (Zhongyang yanjiuyuan), China's national academy of sciences, intended to regulate international researchers' unlimited access to China's natural resources, which had been facilitated by extraterritoriality and the loss of China's tariff autonomy since the 1840s. With its enforcement, the policy essentially established

scientific research as a national enterprise and biological resources as China's national property. Focused on Academia Sinica's policy on foreign biological expeditions in the 1930s, my presentation examines the driving forces behind the institute's nationalizing efforts: (1) the political instability in a transitional era that allowed for the possibility of institutional reforms and new policy-making; (2) the newfound Nationalist regime's commitment to solidify the nation's borders against colonial activities; (3) the transnational nature of the Japanese marine biological study and its potential involvement in the Sino-Japanese fishing wars on the East China Sea; (4) the formation of international academic communities such as biological associations and the global network for specimens exchange; and (5) the presence of a group of Chinese intellectual bureaucrats who dedicated their political power to modernizing China with science. My presentation will conclude with a reflection on the policy's unintended consequences on China's scientific

community, when science became a collectivist interest of the state.

Biology | East Asia | 20th century, early

Natural sciences in the thought of Jabir ibn Hayyan

Marziyehsadat Montazeritabar

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

When Islamic civilization dawned by the emerge of Islam in the seventh century AD, the seed of knowledge was fertilized in the Islamic realm and it was after about a century (i.e., the eighth century AD) that it yielded. This is the beginning of a period of flourishing of Islamic sciences, known as the Islamic golden age. This era is full of scholars who have sought for knowledge, and performed original scientific works. The study of nature was one of the branches of knowledge at that time, which had considerable progress in association with other branches of knowledge. But it should be noted that the science of nature among the golden age scholars was highly dependent upon their philosophical views on nature. One of the Muslim pioneers of this arena is Abu Musa Jabir ibn Hayyan, polymath and alchemist of the eighth century AD. Here we will explain the study of nature in the

works of Jabir in terms of the concept of nature, and the principles and methodology of natural sciences.

Thematic Approaches to the Study of Science | Near and Middle East | Medieval | The Golden Age of Islam, Natural Sciences, Nature, Jabir ibn Hayyan

Nature and Culture in the History of the Earth: F.X. de Burtin's Catastrophist View of Human Progress, the 1780s

Mathijs Boom

Universiteit van Amsterdam

This paper sets out to chart different views of history and progress in the study of the deep past in the late eighteenth century. It focusses on the Brussels naturalist François-Xavier de Burtin (1743-1818) and examines his scholarly network, his letters, a range of published works, and society archives. I argue that Burtin drew on his study of earth history to present a view of human history filled with contingency and catastrophe. In the 1780s, Burtin was among the first to reconstruct the planet's past from traces in fossils, rocks, and strata—explicitly excluding evidence from historiography, antiquarianism, linguistics, theology, and philology, which up to then had been integral parts of the field. Yet Burtin still

saw an intimate connection between the ‘moral’ and the ‘physical’ history of the earth, and explored parallels between natural history and human history. Historians of earth science have noted the use of such parallels before. They point to the influence of antiquarian methods and historical metaphors in the earth sciences, but neglect topics which do not fit the disciplinary trajectories of either natural or cultural history. Burtin's cross-disciplinary thoughts on progress and catastrophe in human and earth history are a case in point. His view of the past illuminates how earth science gave rise to radically new notions of a past shaped by contingency rather than Providence.

Earth and Environmental Sciences | Europe | 18th century | history of the earth sciences, history of cultural history, history of civilization

Nature in Rubrics: The Role of Taxonomies in Translating Arabo-Persian Physiology in Late Imperial China

Dror Weil

Max Planck Institute for the History of Science, Berlin

During the 17th and 18th centuries a network of Chinese savants, interested in studying Arabo-Persian natural philosophy strove to reconcile conceptual and theoretical

differences between the traditional Chinese and Arabo-Persian treatments of the natural world. For that end, members of that Sino-Islamic network experimented with methods of textual analysis and presentation with an explicit aim of bridging the linguistic, conceptual and theoretical gaps. The proposed talk will juxtapose the history of late imperial China's readership and the history of Chinese physiology, and spotlight the methods of translating and interpreting Arabic and Persian physiological knowledge by a number of Chinese savants during the mid-17th and early 18th centuries. It will focus on the use of taxonomies both as a didactic device and as a representation of the natural order. It will bring to light the challenges faced by translators in the negotiation of this foreign knowledge with the established Chinese categories, and the ways by which they were successful in reconciling the theoretical and conceptual differences. In this talk I will argue that organizing knowledge in rubrics was a translation device utilized by the Chinese translators to localize Arabo-Persian theories and concepts, and situate their scholarship on a par with the various

projects of knowledge collecting and organizing that took place in China of the period. At the same time, the use of taxonomies allowed the translators and the promoters of Arabo-Persian knowledge to claim a universal applicability of their translated texts, and their representation of the natural order.

Medicine and Health | Global or Multilocational | Chinese Dynasties/Centuries

Nature in Translation: Transferring Botanical Knowledge in the Early Modern Caribbean (1550-1750)

Jaya Remond
| Tatti

My paper will explore the translation of botanical knowledge on paper, in the context of colonial botany as it was performed by European actors in the New World ca. 1550-1700. I focus on the practices of draughtsmanship and printmaking in the works of a few early modern naturalists and image-makers such as Charles Plumier (1646-1704). The latter was a French cleric but also a trained botanist, later also appointed “King’s botanist” or *botaniste du roi*. Plumier was sent to the French Antilles on different occasions, and he described and depicted in

drawings hundreds of local plants. Through this case study and some other examples, I examine early modern discourses on botanical image-making and analyze some of the drawing methodologies and visual strategies at play in the pictorial productions of early modern naturalists. These practices, as I will argue, involve mechanisms of translation, from an observational event into a graphic act, where translation is performed on two levels: first on the microscale of sketching what is visible in the observed plants, a practice which is akin to visual note-taking, and then on the macroscale of a published inventory or a lavishly produced album of botanical images. Translation from observation to graphics could be carried by the same person, who unusually sought to maintain the whole chain of image production under his/her control, to avoid any possible mistake in the transfer process. In some cases part of a series of efforts in state-sponsored publishing, the graphic act of stabilizing botanical knowledge in drawings and prints also pushes the functional boundaries of paper objects, which offered material means of claiming ownership over new natural and

valuable resources by “harnessing” them graphically and textually.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 17th century |
translation, botanical illustrations, visual
strategies, printing techniques, colonial policies

Nature, Ingenuity, and Invention in Seventeenth-Century Spanish Thought: The Writings of Juan Eusebio Nieremberg (1595-1658)

Jose Ramon Marcaida
University of St Andrews

This paper explores the intersection of ideas about nature, ingenuity (“ingenio”) and invention in seventeenth-century Spanish thought through an examination of the natural historical and natural philosophical writings of the Jesuit scholar Juan Eusebio Nieremberg (1595-1658), the first holder of the Chair of Natural History at Reales Estudios of the Jesuit Colegio Imperial in Madrid (founded in 1629). The paper places particular emphasis on instances of human and animal inventive and ingenious behaviour in the early modern American context: from the unique comportment of certain creatures to various cunning practices involving artefacts and materials. Through a number of books written and published between the late 1620s

and the early 1630s, Nieremberg’s writings offer a rich corpus of information on European and American natural history, including a substantial portion of the materials gathered during the so-called ‘Francisco Hernández expedition’ to New Spain (1570-1577). The paper’s aim is to situate Nieremberg’s take on invention and ingenuity within a larger debate on issues like the fabric of the natural world, the nature of God’s craftsmanship, the moral and cultural dimensions of human and animal behaviour, and their natural philosophical and theological implications.

Thematic Approaches to the Study of Science |
Global or Multilocational | 17th century

Negotiating Tropical Difference: Meteorological Infrastructures in India, 1900-1952

Sarah Carson
Princeton University

Drawing from literatures that reframe meteorology through the lenses of infrastructure and socio-material “assemblages,” this paper considers how the material dimensions of weather science in India were distinctive. Through the production of quantitative data, leaders of the India Meteorological

Department (f. 1875) sought to render the atmosphere above South Asia not only bureaucratically manageable, but also comparable to Europe's, a project entailing the extension of communication and mapping technologies and the recruitment of "native" observers as (often reluctant) human instruments. However, architects of this data-generating apparatus repeatedly expressed concern that the tropical environment and its inhabitants made faithful transplantation of European systems impractical, even if the imperial exchequer devoted adequate resources (it didn't). The core of the paper examines how meteorologists navigated perceived material challenges. First, it considers instructional observer handbooks alongside the coercive figure of the traveling "inspector," whose peculiar responsibility it was to discipline troublesome observers and calibrate their finicky, fragile instruments. Next, it discusses the gradual replacement of expensive, often climatically-unsuitable European instruments with domestic alternatives or new inventions altogether, suggesting that the trend toward substitution accelerated because of the requirements of upper-air balloon researchers in

Agra. Finally, it investigates the short-lived project to gather and statistically assess vernacular weather proverbs, an enterprise grounded in a 1950s nationalist critique of "foreign" methods for studying India's weather. These cases help us to understand how the instabilities of modern weather-data networks reciprocally influenced broader theories of tropical difference advanced by imperialists and nationalists alike, if for quite different reasons.

Earth and Environmental Sciences | South Asia | 20th century, early | Infrastructure, instruments, weather proverbs, India, observer handbooks

Neutron Partners: Nuclear Science and Diplomacy at the European Spallation Source

Thomas Kaiserfeld
Lund University, Sweden

Since 1945, nuclear science and technology have oscillated between nationalism and internationalism. While the first decade after WW II was mostly characterized by military applications and national security, the launch of the American Atoms-for Peace-program in late 1953 promoted international cooperation. As a consequence, the International Atomic Energy Agency (IAEA) of the United Nations was formed in

1957 to support peaceful applications of nuclear science. More or less simultaneously, Euratom was formed by the members of the European Economic Community (EEC) as a first attempt to promote cooperation also in science and technology. Already by the late 1950s, nuclear science and technology was thus connected to internationalization processes paralleling efforts in different countries to advance atomic weaponry. Since then, facilities for nuclear research include a mix of national labs such as the one in Oak Ridge, and international ones, for example Institute Laue-Langevin inaugurated in Grenoble in 1970, which includes a significant measure of science diplomacy between France, Germany and the UK. In the mid-1990s, OECD endorsed the construction of three nuclear spallation sources in America, Europe and Asia. This resulted in SNS in USA 2006 and JSNS in Japan 2008 while the most powerful of the three, the European Spallation Source (ESS), in contrast relying on a number of partner countries complicating decision, funding and design processes, is still under construction in Lund in southern Sweden. This example shows how

interactions between science and diplomacy may be necessary to create larger facilities while simultaneously prolonging their creation.

Aspects of Scientific Practice/Organization | Europe | 20th century, late

New Health Educators: Film as Public Educational Tool Challenging Concepts of Health and Disease (Medical Film Collections in Austria)

Katrin Pilz

Université Libre de Bruxelles, Universität Wien, Ludwig Boltzmann Institute for Digital History

Medical research-, educational-, and public health films have recently been rediscovered by archives and scholars in different fields. The institutional turn to the proper production and distribution of medical films in Austria starts with the founding of the Staatliche Filmhauptstelle in Vienna in 1919 as well as activities of the Uraniafilm department from 1922 on, the Schulkinobund in 1925 and international educational film associations debating on the psychological and didactical value and uses of hygiene, sex education and disease/accident prevention films and their impact on respective target groups in a more structured

way. The implementation of film in higher and public education after WWI and the visualisation of scientific and physiological phenomena now visible through mechanically reproduced motion pictures, such as X-ray films, microcinematography or invasive surgical and obstetric training films, helped to promote but also challenged complex fields such as medicine and public health. The delay in and relative sparseness research on medical educational films have a variety of archival and conceptual reasons. Many collections of medical (educational) films in Austria and elsewhere, after their use value expired, were forgotten, disposed of or stored away in hospital vaults without proper archival care. Their separation from accompanying materials (production notes, research reports, teachers' guides, booklets) further hindered the evaluation and appreciation of these collections' significance.

Medicine and Health

New Methods for Old Questions: Sally Hughes-Schrader, Franz Schrader, and Problem-Solving in Cytogenetics

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Wayne State University

The collaborative marriage in 1920 between Sally Hughes and Franz Schrader emerged following their interaction at Woods Hole and the Zoology Department at Columbia University. Their personal and scientific interests matched perfectly, and they forged a fruitful scientific partnership that lasted over four decades. Both were avid naturalists before deciding to pursue graduate work in zoology. As students of E. B. Wilson, they became leading American cytologists (Franz indeed succeeded Wilson at Columbia in 1930). They were also influenced by interaction with T. H. Morgan and his group. Their long-term focus on chromosomes and their role in heredity, combined with avid field work to collect novel organisms, provides a model study by which to consider how "interfield" theories, methods, and approaches helped define the newly developing field of cytogenetics in the 1920s and 1930s. It also illuminates critical aspects of

the reception of C. D. Darlington's "new cytology" in the 1930s.

Biology | Global or Multilocational | 20th century, early | genetics, cytogenetics, field work, chromosome theory of heredity,

New Theories for New Instruments: Fabrizio Mordente's Proportional Compass and the Genesis of Giordano Bruno's Atomist Geometry

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The aim of this paper is to shed light on an understudied aspect of Giordano Bruno's intellectual biography, namely, his career as a mathematical practitioner. Early interpreters, especially, have criticized Bruno's mathematics for being "outdated" or too "concrete". However, thanks to developments in the study of early modern mathematics and the rediscovery of Bruno's first mathematical writings (four dialogues on Fabrizio's Mordente proportional compass), we are in a position to better understand Bruno's mathematics. In particular, this paper aims to reopen the question of whether Bruno anticipated the concept of infinitesimal quantity. It does so by providing an analysis of the dialogues on Mordente's compass and of the historical circumstances

under which those dialogues were written. Mordente's compass was almost unknown until the late 1800s, as its existence was overshadowed by that of another proportional compass, invented by a better-known Italian scientist: Galileo Galilei. However, Mordente's compass did not go completely unnoticed by his contemporaries, catching the eye of technicians and mathematical practitioners, but also of speculative thinkers like Bruno. Puzzled by the novelty of Mordente's invention, Bruno offered to write an exposition of the compass in the form of dialogues. In these dialogues, in an attempt to provide a theoretical explanation for the use of the compass, Bruno presented the first version of his atomist geometry based on the concept of the "minimum". This minimum was in essence an infinitely small quantity. As such, I argue that it can be regarded as a forerunner of the infinitesimals.

Mathematics | Europe | Renaissance | Giordano Bruno, Fabrizio Mordente, History of mathematics, Mathematical practitioners, Proportional compass, Infinitesimals.

New Tools for Making New Materials

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There is no bright line between representing and intervening – even microscopes can be used to, for instance, fabricate atomically-precise devices. Yet materials scientists routinely make a rough distinction between tools associated with characterization and those associated with fabrication. In general, historians and philosophers have paid more attention to the latter, perhaps because they were more easily folded into debates about representation and reality. In the past few years that tide has slowly changed, with recent studies of (among others) experimental refrigeration by Joanna Radin and ion implantation and molecular beam epitaxy by David Brock and collaborators. In this paper I review the various fabrication techniques that our collection examines. I use that survey to argue that in the Cold War, policymakers and many materials researchers themselves focused on fabrication techniques relevant to four domains of application: missiles/space, nuclear weapons/energy, computing, and oil. I quickly review a representative

fabrication apparatus – Rick Smalley’s AP2, which enabled the Nobel-winning discovery of buckminsterfullerene – and its links to all four of those domains. Researchers allied with these four domains were both producers and consumers of new fabrication techniques. Indeed, the desire to move new tools across interlinked domains was one of the hallmarks of postwar materials research. Since the end of the Cold War, a new domain has become increasingly prominent: life. Biological systems were never absent from materials research, but since the 1990s their importance has increased – both as parts of fabrication apparatus, and as drivers of innovation in fabrication apparatus.

Physical Sciences | Global or Multilocational |
20th century, late

Non-Mathematical Approaches to Theoretical Biology in the Postwar Period

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Over the course of the twentieth century, theoretical biology changed beyond all recognition. Although the field today is synonymous with mathematical biology, when it first emerged it had a drastically different

agenda: to critically analyze the conceptual foundations of biology in order to resolve longstanding theoretical disputes and bring about the epistemic unification of biological science. The field began acquiring its now familiar mathematical character in the 1930s and 40s, as formal models became increasingly applied in different areas in biology, such as ecology and evolution. With the rise of molecular biology in the 1950s and 60s the non-formal, philosophical approach to theoretical biology that had been dominant in earlier decades came to be perceived as old-fashioned and irrelevant, if not downright pernicious. Nevertheless, a few authors attempted to rehabilitate this older tradition, arguing for the necessity of philosophical reflection about the theoretical basis of biology. This paper explores these efforts and tries to understand why they ultimately failed to convince the broader biological community about the importance of ‘doing theory’. It discusses the neglected work of Walter Elsasser, Arthur Koestler’s Albach symposium on the limits of reductionism, Conrad Waddington’s Serbelloni meetings that led to the publication of the four-volume series

called *Towards a Theoretical Biology*, and Brian Goodwin’s challenge of the Neo-Darwinian paradigm and his unsuccessful promotion of ‘process structuralism’. Although these developments have been mostly forgotten, they are crucial for understanding how views regarding the role of theory in biology have changed in the last hundred years.

Biology | Europe | 20th century, late |
Theoretical Biology, Mathematical Biology,
Structuralism, Walter Elsasser, Arthur Koestler,
Conrad Waddington, Brian Goodwin

Normal Children: Developmental Research and Educational Film for the New Deal

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Leuphana Universität Lüneburg

This paper investigates how scientists and film-makers at the Yale Clinic of Child Development redefined normal child development and established norms of human behavior and social interaction. Part of the evolving science of child development in the interwar years, these researchers sought techniques to observe and manage the development of babies and young children. They built an experimental film studio with the scenic design of an everyday living environment that reflected ideas about a normal

middle-class home. In this Naturalistic Studio, they filmed normal white babies for research and education. Not only did the researchers use the babies to study human development, their research product, the films of baby's bathing, feeding, and play also became part of a national education program of the New Deal. The notion that knowledge of the normal child could be used for the visual education of the nation informed research methods, setting, and design. This paper considers the effects of the twin-function of both normal child and film for knowledge production and communication. While many historical studies of educational films or of children have focused on knowledge circulation, this case study demonstrates how the child being a tool for educational intervention had a consequential role in scientific knowledge formation. Considering the combined scientific and educational significance assigned to baby and child, this paper sheds light on the human sciences' intersecting effects of research and visual education. The normal child in the cinematographic laboratory mutually shaped

scientific method and developmental theory as well as daily life.

Medicine and Health | North America | 20th century, early | children, film, practices of knowledge production, education

Of Ideas and Ideals: Biography as Analytic Tool

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By recognizing the essential, lived dimension of the ideas people use to organize their thinking about the world, biography has the potential to restore motivating ideals to historical understanding. In this paper I will develop this thesis by considering the ways the idea and ideal of reason were supported and shaped in the lives of a family that flourished from the middle of the eighteenth to the end of the nineteenth centuries. All of the members of this family were convinced that reason defined their essence as human beings, and although some of the details changed over time, all were essentially agreed on the basic parameters of the reason that defined them as human thinkers. Nonetheless, over the course of their lives, their ideas of reason were severely tested by their lived experiences. Their conviction that

the ability to reason constituted the essential definition of what it was to be human was challenged by efforts to establish a constructive relationship between English gentiles and Jews, by the intense experience of raising young children, by harrowing confrontations with sudden and untimely death. Biography offers a means of restoring the negotiations between the idea of reason and these lived experiences to the historical record. By so doing it deepens our understanding of the directions in which ideas of reason developed, in response to their role as an ideal that shaped human lives.

Tools for Historians of Science | Europe | 18th century

On Being Sane in Insane Australian Places: Robin Winkler's Pseudo-Patient Experiments

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University of Sydney

After conducting path-breaking experiments on introducing token economies in mental hospitals, Australian psychologist Robin Winkler spent a sabbatical in the United States (1970-1971). There, he became acquainted with anti-psychiatry and initiatives in

community mental health. After returning to Australia, he repeated David Rosenhan's famous experiment *On Being Sane in Insane Places*. After two (mentally healthy) psychology students were admitted to a mental hospital, they behaved normally and made observations about the care provided (which left much to be desired). He also conducted a pseudo-patient experiment with general practitioners; students visited them and presented symptoms of depression. In general, discussions between physicians and pseudo-patients were short, no referrals were organised, and all received prescriptions. Winkler conducted these experiments for two reasons. First, he thought that they provided unique insights into the nature of mental hospitals and general practice (he recommended that they were repeated every few years). Second, these experiments were part of a broader critique on the place of medicine in modern society. Winkler was part of a small group of radical psychologists that criticized

psychiatry and medicine during the 1970s and 1980s to realize change.

Medicine and Health | Australasia/Oceania | 20th century, late | anti-psychiatry, mental hospital, deinstitutionalization, community mental health, mental illness.

On Objects and Bodies: Non-Representational Theory and Medical Materiality

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University of Copenhagen

Within museum studies, there has been a recent interest in engaging with objects and their material effects as something other than vehicles for human cultural meaning, arguing that there has been a tendency to miss out of “an examination of the physical actuality of objects and the sensory modalities through which we experience them” (Dudley 2010). This paper builds on this interest in materiality, applying it to the study of medical objects. It will present three theoretical notions – anecdotes, metonymies and the punctum – that in different ways contribute to a non-representational vocabulary and toolbox.

Medicine and Health | Europe | 21st century | material cultures, museum studies, medical artifacts

On the Early Postwar Public Culture of History of the Science Museum, London

Tim Boon

Science Museum Group

The staff of the Science Museum in the Second World War years were faced with a dilemma. With its first purpose-built building opened in 1928, only two decades later they already felt their displays to be very old-fashioned. The galleries devoted to evolutionary sequences of technologies divided by textbook divisions – such as optics, acoustics, mechanical engineering and the rest – felt to many of them to be tired, lacking the modernity and sophistication of Paris’s Palais de la Decouverte, opened in 1937. When the independently produced science exhibition of the Festival of Britain, itself an exemplification of the Parisian style, opened on a site behind the Museum in 1951, the contrast was sorely felt. At stake was whether to exhibit scientific principles in the modern style, or whether to display assemblages of historical objects. In other words, the temporary 1951 exhibition made evident an immanent distinction between exhibiting science and exhibiting its history. Into this ferment stepped 1950’s new

director, Frank Sherwood Taylor, the only historian-director the institution has known. In this paper I explore some of Sherwood Taylor's responses to the Museum's postwar dilemma over history and propose an interpretation of how he squared the circle of contemporary versus historical approaches to science.

Theoretical Approaches to the Study of Science
| Europe | 20th century, late | Museum History
of Science

On the Role and the Process of Drawing in the Record of Microscopy Observations: The Histological Work of Abel Salazar

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The present paper looks at the research work developed in the early twentieth century by the histologist Abel L. Salazar (1889-1946) to explore the role of visual representations in the production of scientific knowledge. Medical doctor, professor, scientist and visual artist, Abel Salazar is a multifaceted figure of the Portuguese cultural setting of his time. Resorting extensively on the so-called tannin-iron staining method in the study of mammalian tissue slices, Salazar's writings also

include the procedure of microscopic drawing. These texts are an expression of the methodological concern that is well present in his research work. Building upon published texts (papers and textbooks), as well as archival sources, my analysis focuses on his effort in reflecting on the process of drawing in the record of microscopy observations and in the training of the researcher as observer. I will argue that staining and drawing are closely linked tools in his work, both present at the level of knowledge production, and, more broadly, that drawing may have an important epistemic role in the scientific practice.

Aspects of Scientific Practice/Organization |
Europe | 20th century, early | visual
representations; life sciences; drawing

On Transmitting, Transcribing, and Arranging Astronomical Knowledge in 14th/15th Century Byzantine Manuscripts

Alberto Bardi
Independent scholar

Byzantine scribes and copyists working with manuscripts stemming from the fourteenth and fifteenth centuries employed several strategies on arranging and presenting knowledge with regard to astronomy and astrology, especially

reworking Greek-Ptolemaic astronomy and incorporating Islamic astronomical materials. From manuscript evidence we are able to reconstruct some significant cases of strategies that lead to cases of circulation of knowledge, as well as learning, teaching, comparing, and studying. Scribes and copyists carefully crafted their instructions on how to use astronomical tables and arranged quires thematically in manuscripts. Writing astronomy is thus learning how to be able to master a stylistic code. To explore these topics, I will examine the 14th/15th century Greek manuscripts Vaticanus graecus 1059, Vaticanus graecus 792, Marcianus graecus Z 323 and Z 333, which illustrate important decisions about textual arrangement and selection of manuscripts in single volumes with regard to astronomical and astrological texts.

Physical Sciences | Europe | Medieval | medieval, astronomy, astrology, pedagogy, Byzantine, manuscripts, Greek, Ptolemy

On Ways of Dying: Biographies of Metaphors and the History of Science

Lily Huang

The University of Chicago

In the nineteenth and twentieth centuries metaphors acquired

biologies, and then biographies. Emerson, in 1842, said “Language is fossil poetry”; modernist poets and critics gave criteria for what made a “healthy metaphor”; and it became possible for a metaphor to die. A dead metaphor is a once-figurative expression whose figure, vivid in the past, is no longer apparent. In contrast, the figure in a live metaphor is present and active, wrenching around the order of things. Some causes of death are ascertainable by literary scholars; others need to concern historians of science. This paper shows how historians of science are in a privileged position to observe the lives and deaths of metaphors. My main exhibit will be metaphors of perception in late-nineteenth-century psychology and physiology. These are metaphors whose differences once formed the basis of theoretical disagreements, about the contribution of the perceiver and the integrity of the perceived. Since that period of diversity and contest, these metaphors—such as the “stream of consciousness”—have incurred death by two counts: death by consolidation and death by banality. I show how science is implicated in these deaths, by the changing of scientific theories and, equally, by

theories consolidating or gaining empirical verification and acceptance—thus no longer requiring the epistemic work of a live metaphor. I argue that metaphors live precariously in science, but to mark their time of life is to restore their distinctive potency and to better recognize, for a particular historical moment, the nature of its epistemic freedom.

Tools for Historians of Science | Europe | 19th century

Overwork and Sleeplessness in Victorian Culture

Sally Shuttleworth
Ms

At the close of the nineteenth century, a writer in the *Lancet* commented that ‘Sleeplessness is one of the torments of our age and generation’. He thus articulated the perception, which had been the source of mounting cultural and medical anxiety over the previous decades, that the conditions of ‘modern life’ of the late nineteenth century were responsible for a serious threat to public and individual health. This paper traces those concerns across scientific, medical and cultural texts, exploring their intersections, and the ways in which physiological researches on

brain functioning during sleep were linked to popular, alarmist accounts of the consequences of sleep deprivation. It looks at a few high profile cases of sleeplessness (including Gladstone and Tyndall), as well as lesser-known case studies, and the emergence of the medical category of what Benjamin Ward Richardson identified as ‘disease from late hours and broken sleep’. The paper will explore the interlinked notions of overwork, and sleeplessness, and the identification of both primarily with the professional classes, and the young in educational establishments.

Medicine and Health | Europe | 19th century |
Insomnia, Overwork

Paleoanthropological Futures and Historical Pasts: Human Origins and Rewriting the Place of Africa in World History

Emily Kern
University of New South Wales, Sydney

The science writer Robert Ardrey began his 1961 book *African Genesis* with the arresting line: “Not in innocence, and not in Asia, was mankind born.” But by the end of the decade, it might have been unnecessary to include the second intervening phrase. Although the “out of Asia” hypothesis of human

origins dominated models of human origins and prehistoric migration from the eighteenth to the mid-twentieth centuries, it was rapidly replaced in both scientific circles and public awareness by the theory of African origins in the 1950s and was all but forgotten by the end of the 1960s. This talk explains how the rapid pivot from Asia to Africa could take place and examines the historiographic deployment of African origins in new world history writing in the 1950s and 1960s, in order to understand how the monumental history of the Asian origins hypothesis came to be so rapidly forgotten. In highlighting the position of hominin fossil evidence within this historiography, the goal is not to critique the use of non-textual sources in history writing, or the implications of writing history in a long temporal perspective, but rather to call attention to the “extra-objective” status that certain kinds of scientific knowledge were sometimes granted—and to show the implications of this method for how we understand the intellectual and cultural history of the out of Africa hypothesis.

Earth and Environmental Sciences | Africa |
20th century, late | human origins, world history,
palaeoanthropology

Panel Discussion: Materials Research and Its Toolkit

Joseph D. Martin
University of Cambridge

A panel discussion with the audience.

Physical Sciences | Global or Multilocational |
20th century, late

Panel Discussion: Towards a History of Theoretical Biology

Daniel Nicholson
Konrad Lorenz Institute for Evolution &
Cognition Research

Biology

Paradigms Old and New: Twentieth Century Intersections between Kuhnian Revolutions and the Dutch Catholic Faith

Michelle Marvin
University of Notre Dame

The question of how Thomas Kuhn’s work, *The Structure of Scientific Revolutions*, has been received by the Catholic church is a topic that has garnered small bursts of attention over the last fifty years. Theologians such as Hans Küng and David Tracy have explored the possibility of analogizing paradigm shifts with dogmatic changes in the history of Christianity, while other scholars such as Paul Ricoeur and Matthew Lamb have taken a hermeneutic approach to scriptural paradigm analysis. However, one

perspective that has not received scholarly attention belongs to the twentieth century Dutch Catholic theologian Edward Schillebeeckx, who used Kuhnian epistemological theories as the basis for his 1974 statement that Jesus is the “paradigm of humanity.” My paper proposes that Schillebeeckx incorporated scientific models and Kuhnian paradigms into his influential three-volume Christological work as a response to the mid-twentieth-century European cultural milieu. To support this claim, I examine the way Schillebeeckx countered a debate with his colleague at the University of Nijmegen, Ansfried Hulsbosch, who argued for a scientific evolutionary account of the person of Christ. Further, I discuss how Schillebeeckx prepares his readers with a thorough understanding of the ancient Greek concept of paideia and a Platonic understanding of the divine paradeigma prior to introducing Kuhn’s work. I argue that Kuhn’s paradigm becomes integrated into Schillebeeckx’s work through his historical-critical research. In conclusion, by examining Kuhn’s influence on Schillebeeckx’s theological work, I demonstrate the unrecognized way in which Kuhn’s

work has influenced the Dutch Catholic church.

Thematic Approaches to the Study of Science | Europe | 20th century, late | Paradigm, Thomas Kuhn, Edward Schillebeeckx, Paideia, Catholic Church

Parasites and the Postcolonial: Renewed Japan-Korea Medical Collaboration and South Korean Developmentalism, 1964-Early 1970s

John Dimoia

Seoul National University (SNU)

This paper (undertaken with Aya Homei of Manchester University) depicts how anti-parasite and family planning campaigns developed in Japan and Korea independently after the Second World War, as specifically domestic public health initiatives that directly contributed to the post-war reconstruction (Japan) and nation-building (South Korea) exercises, and examines how they were later incorporated into development aid projects from the 1960s. In the South Korean case, leading parasitologists, including Dr. Seo Byung Seol (1921-1991) of Seoul National University, re-engaged with their Japanese colleagues, while also reaching out to Southeast Asia as a mentor, and potential model. By juxtaposing domestic histories of Japan as a

former coloniser, and South Korea as its former colony, the paper explores colonial legacies in post-war medical cooperation in East Asia. Furthermore, by clarifying how Japanese and South Korean development aid projects both grew from the links that existed in their respective domestic histories, the paper aims to highlight complexities engrained in the history and to shed new light into a historiography that often locates the origins of development aid in colonial history. If South Korean developmentalism dates its origins to this intense period of networking (late 1960s, early 1970s), the outreach remains distinct from the colonial period, even while containing uncomfortable resonances with it.

Thematic Approaches to the Study of Science | East Asia | 20th century, late | Medical collaboration, postcolonial, parasites, developmentalism, public health, the politics of international cooperation, global Cold War

Past Climates, Volcanoes, and Earth Analogues: Soviet Articulations of Climate Futures

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While mindful of the broad range of climate science at work in the Soviet Union, this paper focuses primarily on the use of natural analogues for

comprehending possible climate change and articulating climate futures. The paper is divided into three main sections. First, it reflects generally upon the ability of natural analogues to inform our understanding of contemporary physical systems and with particular reference to debates around future climate change. Second, it places the Soviet use of natural analogues within the context of the broader climate change debate at play within the Soviet Union from the 1960s through to the end of the 1980s. This debate embraced a range of approaches and disciplinary areas. Third, it examines the use by Soviet science of natural analogues for understanding the Earth's climate system via such phenomena as volcanic eruptions, large-scale historical natural disasters, Earth analogues and past climates. The paper concludes by suggesting that Soviet use of natural analogues was indicative of concerted scientific efforts to further understanding of the Earth's climate system and its future state. Their use also encouraged an appreciation of the possibility of marked future changes in the Earth's climate, whether natural or anthropogenic in origin,

with potentially challenging consequences for humankind.

Earth and Environmental Sciences | Europe | 20th century, late | Soviet Union, Climate Change, Climate analogues

Patho-Physiognomy: The Body of the Artisan as a Site of Disease and Social Identity

Paola Bertucci

Paola Bertucci, Yale University

In 1700 the Italian physician Bernardino Ramazzini published the first treatise on the Diseases of Artisans. Originally published in Latin, the text was soon translated into several languages and annotated, updated and republished several times in the course of three centuries. Ramazzini, referred in his time as the third Hippocrates, rose to fame again in the twentieth century as the “father of occupational medicine,” with medical institutions and journals named after him. This paper will shift the focus away from Ramazzini to discuss instead the success of the Diseases of Artisans in the context of the early modern interest in artisans’ bodies as repositories of practical knowledge and material intelligence. I will argue that Diseases of Artisans was not just a medical text but also a sort of costume book that merged pathology and physiognomy. While

contemporary works on artisans represented the arts through tools, materials and artefacts, Diseases of Artisans characterized each craft by the kind of body that its practitioners acquired because of their exposure to specific substances or repetitive actions.

Medicine and Health | Europe | 18th century | Social diseases, observational medicine, artisanal skills, physiognomy, history of the body

Pen to Print in 18th-Century Mathematics: Boscovich Uses the Page

Robin Rider

University of Wisconsin-Madison

Roger Boscovich’s career traversed much of Europe; his work, topics from astronomy to geodesy, optics to mechanics, mathematics to natural philosophy. When he put pen to paper, Boscovich deployed writing practices with a long history, from consistent partitions of the page and organizational schemes of sections and paragraphs to carefully drafted diagrams and layers of changes in the margins. One of those authors who (in Karine Chemla’s words) “design their texts at the same time they design concepts and results,” Boscovich mixed an older language of proportions with algebraic expressions in multiple

variables, subjected both numerical data and mathematical relationships to tabular organization, narrated algebraic transformations in prose, and told readers what to see in his diagrams. His pen was much in action in his drafts; and his papers bear those traces. Fair copies produced by others helped to reconfigure his intentions; typesetters then invoked typographic conventions. In Boscovich's body of work we can thus trace the fluidity of pen strokes and fixity of print in constructing the page and modeling mathematical thinking.

Aspects of Scientific Practice/Organization | Europe | 18th century | scientific publication, mathematics, manuscripts

Personas and Personifications: Galileo Compared

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Universiteit Utrecht

Galileo Galilei's contemporaries repeatedly compared him to other famous men, such as Archimedes, Columbus, Vespucci, and Michelangelo. With these comparisons, contemporaries enhanced Galileo's fame, status and credibility, while also creating possibilities of understanding Galileo and his scholarship. In this paper I connect these comparisons to

the concept of the scholarly persona, as developed by (among others) Daston, Sibum, and Algazi. The paper studies the significance of these comparisons as attempts to contribute to, shape and negotiate Galileo's scholarly persona. To better understand this mechanism, the paper first examines the various comparisons in the textual and material contexts in which they arose. The paper analyses the different personae assigned to Galileo, and the extent to which these were complementing or conflicting in nature. Secondly, the paper investigates the inherent tension with regard to these comparisons: while they helped advance Galileo's status as an individual scholar by embedding him in a tradition of great men, they simultaneously detracted from his unique genius by doing so. As such, the paper leads to a better understanding of the importance of fame for scholars, in particular in relation to their careers and credibility. Finally, by also taking the mythological figures Galileo was compared with into account, the paper highlights the different traditions at the basis of the cultures of scholarship and fame in early modern Europe. As such, it not only

sheds light on the development and significance of Galileo's fame, but also on the developing persona of the seventeenth-century scholar in general.

Aspects of Scientific Practice/Organization | Europe | 17th century | Persona, fame, reputation, scholarly myths, Galileo Galilei

Photographing The Sky: Female Work in Astronomical Observatories

Lorena B. Valderrama
University Alberto Hurtado

The contribution of women to astronomy has been studied focusing in European and North American observatories (Kistiakowsky, 1979, Rossiter, 1984, Pérez and Kiczkowski, 2010). However, we do not know about the contribution to global projects of female South American astronomers, who have been excluded from the local histories of these scientific institutions, often because their contribution has not been in the records of their contemporaries (institutional reports or scientific publications). Photometry was a task rejected by many men and assumed by women who began working in astronomical observatories during the second half of the nineteenth century and the first decades of the twentieth century. This proposal is

part of the Fondecyt Regular 1170625 project "Looking at the stars of the south of the world: The National Astronomical Observatory of Chile (1852-1927)" and analyze the role played by the women workers at the National Astronomical Observatory of Chile, who participated in the observation and registration of Halley's Comet in 1910 and of the Cape Photographic Durchmusterung.

Physics for the Believers: The Translation and Reception of Pascual Jordan's *Forschung Macht Geschichte* in Finland in the 1950s

Ahto Apajalahti
University of Helsinki

The German physicist Pascual Jordan (1902-1980) is renown not only for his contributions to the development of quantum mechanics but also for trying to reconcile religious and scientific world views. Science, he thought, had repealed materialism. Aiming at a wider audience, Jordan lectured at Radio Bremen. These lectures were reworked in 1954 into a book *Forschung macht Geschichte* (Science and the course of history). The book was translated in 1956 into Finnish (*Tutkimus luo historiaa*) by Dr. Reino Tuokko, who had a PhD

in nuclear physics and was the most prominent Finnish popularizer of physics during the early Cold War period. In his book, Jordan argued for a greater role for science in society and culture. He also both defended science from religious criticism, and Christian faith from materialist criticism. In other words, Jordan argued physics for the believers; he attempted to convince a conservative Christian audience of the importance of science and its compatibility with religious faith. His translator Dr. Tuokko subtly commented on Jordan's ideas in his own original works. Jordan's ideas also resonated with the wider intellectual climate in Finland. I present the case of Jordan's *Forschung macht Geschichte* and its transnational influence from the cross-section of intellectual history, cultural history of science and history of popularization. I also consider theoretical aspects on how people employ knowledge for cultural and ideological purposes.

Physical Sciences | Europe | 20th century, late |
Physics, Popularization, World view

Pick Your Poison: Insecticides and Locust Control in Colonial Kenya

Sabine Clarke
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Literature on the use of insecticides in the tropics after 1945 is preoccupied with the WHO's Malaria Eradication Programme. This scholarship describes a form of technological hubris in which scientists rushed to deploy the quick fix of DDT on the widest possible scale, fuelled by belief in the power of Western science and buoyed by Allied victory. This paper focuses on trials to control locusts in Kenya after 1945 using synthetic insecticides to tell a different story. It shows that discussion about synthetic insecticides in Britain's African colonies was not characterised by calls for rapid and far-reaching application of new chemicals. Caution arose in part because of concern about the costs of new programmes. This reflected the weaker economic position of Britain in comparison to the USA, backers of the WHO programme, but more importantly, new locust control substances such as gammexane were evaluated in Kenya against pre-existing ones. In other words, the notion that DDT

and related chemicals were wonder weapons of such power that they marked a radical departure from past measures, and rendered all previous insect control methods obsolete, is not borne out by this study. The use of the new insecticides was dependent upon calculations of advantage versus cost in comparison to well-established existing methods. In addition, previous experience with arsenic bait and pyrethrum shaped the testing and deployment of gammexane in significant ways, including evaluation of its toxicity. The perception of the new chemicals as part of a continuum of poisons also informed the attitudes of Kenyan herdsman. Their suspicion of gammexane was not merely the result of a distrust of Western science and the colonial government, but arose directly from the experience of seeing their cattle poisoned by arsenic bait during the interwar years.

Biology | Africa | 20th century, late |
Entomology, Kenya, agriculture, livestock,
colonialism

Piracy, Slavery, and Eating in the Southern Pacific, 1580s-1720s

Tamara Walker

University of Toronto, Department of
History

My paper is set in the Southern Pacific, or the part of the ocean that connected East Asia to Central and South America, from the late-sixteenth to the early-eighteenth century. With merchant vessels loaded with American silver, African slaves, and global luxury goods circulating throughout the region, it was one of the most active commercial zones in the world. And for Spain's European rivals, it was an attractive target for incursions. Yet among the European pirates and privateers making their way into the region, satisfying hunger was a surprisingly difficult - and distracting - part of their experience at sea. With little knowledge of their own about what was safe to eat, they had to rely on outsiders to help them gain access to food. This group primarily consisted of black men and women taken captive during raids of slave ships, merchant vessels, and Spanish-American port cities, who possessed the local and scientific ability to determine which parts of which plants, fruits, and animals could be eaten or even treat

diseases. In drawing upon the accounts of those Europeans, my paper centers the intellectual labor of African-descent men and women, highlighting the ways they deployed their knowledge in service to their captors, often against their will but also as a means to secure their freedom. It also considers the risks involved in such efforts, given the possibility of making mistakes that could endanger the health of their captors and in turn put their own lives in further danger.

Medicine and Health | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general | Piracy, slavery, food, medicine

Plant Drawings and Plant Scholars in the Late Middle Ages

Dominic Olariu

University of Marburg, Department of Art History; Gotha Research Centre of the University of Erfurt

This paper enquires the status of late medieval botanical scholars and their capacity to create botanical illustrations. Were plant scholars in the late Middle Ages able to draw at all? Could their own drawings be helpful for the plant studies they performed? Since Antiquity and throughout the Middle Ages, painting plant illustrations had been a thorny issue. The ancient seminal

naturalist Pliny d. E. had put the problem in a nutshell in his book *Naturalis historia* as follows: artists lacked crucial the botanical knowledge when copying plants from nature or even when making copies of other plant illustrations, and hence introduced unwillingly morphological mistakes in their illustrations. Scholars, on the other hand, had good botanical knowledge, but were not able to paint. Hence, scholars who were able to paint or draw would have contributed to resolve this old problem. The paper presents and discusses case studies from the fourteenth and fifteenth centuries and shows how plant scholars were involved in the creation of plant illustrations.

Thematic Approaches to the Study of Science | Europe | Medieval | botany, botanical illustrations, plant scholars, drawings

Plant Research in the Age of Public Engagement

Vanessa Sellers

New York Botanical Garden, Humanities Institute

The creation of The New York Botanical Garden, an International Plant Research Center at the heart of New York City—and the programs of study that followed since the 1890's—have helped lay the

foundation of ecology as a discipline in America. The Garden now connects an ever larger community of individuals to plants through citizen science programming. Active public involvement by ‘amateur naturalists,’ is ever more essential today to document the planet’s rapidly decreasing biodiversity. What can we learn from past and present approaches to environmental scholarship? Public engagement plays an indispensable role in the democratization of science by involving an increasingly diverse force of global and regional participants in a common effort to advance environmental knowledge and stewardship. The citizen science movement is reflective of wider societal forces and trends of interconnectedness: it encourages the establishment of new communities of activists that find common purpose to rally around local issues that may address broader environmental, legal and humanities concerns. This movement is supported by easily accessible new technologies—from extensive computer networks to cell phones with sophisticated apps, such as iNaturalist which the New York Botanical Garden uses for its EcoQuests; a program challenging

New Yorkers to become citizen scientists and sustain nature in the City. Today’s rapidly evolving online social networks sharing observations on plants across the globe benefit Big Data and meta-analyses. Increased plant awareness in the public sphere has important consequences: it helps to mitigate plant blindness and catalyzes much needed further conservation action.

Thematic Approaches to the Study of Science

Politics in the Bedroom: Paolo Mantegazza and the Rise of Sexual Medicine in Post Unified Italy (1861-1900)

Cristiano Turbil

University College London (UCL), UK

In the late nineteenth century, questions regarding hygiene and public health became central to the medical, cultural and political debates in Italy. Particularly during the first few decades after the unification (1861), public health campaigns became a key element in the creation of the new kingdom. One of the key figures who contributed to the establishment of the practice of hygiene in the country was the polymath Paolo Mantegazza. Mantegazza introduced the culture of hygiene in a variety of ways: from laboratory and hospital

practice to the creation of sexual medicine. The Italian polymath published widely on sexual medicine for both the professional and general audience with controversial books such as *Physiology of Love* (1873), *The Sexual Relationship of Mankind* (1886) and *The Art of Taking a Wife* (1894). The aim of this paper is to look specifically at his physiological work on sexuality, showing how the control and management of any sexual desires became key to the welfare of the new kingdom. This paper will also look at how the author communicated his controversial ideas about sex and its practices to the general public. This will provide an overview of the circulation of controversial medical knowledge in the post-unification Italian context and the importance this had for national public health.

Medicine and Health | Europe | 19th century

Population Genetics, Genetic Variation, and the Monomorphism of the Human Species

Jean-Baptiste Grodwohl
Université Paris Diderot - SPHERE

This talk will relate discussions about human genetic variation (a key issue in the debates on human

racism) to the history of theoretical population genetics. In the first part of the presentation, I will analyse how two prominent statistical population geneticists, namely Newton Morton and Masatoshi Nei, used the concept of race in a series of studies that took place from the late 1950s to the late 1980s. I will argue that a proper understanding of these lines of work requires considering more general debates on population genetics theory, such as the classical-balance debate, and the debate on the neutral theory of molecular evolution. In the second part of the presentation, I will move away from the focus on variability and consider the issue of genetic monomorphism. Although the science of population genetics has been typically concerned with the study of genetic variability, not all genes present variation. An interesting outcome of molecular studies of human variation has been to show that the proportion of polymorphic loci may be minute, with current estimates suggesting that humans rank among the most monomorphic species. My purpose will be to reconstruct how geneticists came to view humans as genetically monomorphic, and to assess its implications from the

viewpoint of population genetics theory.

Biology | Global or Multilocational | 20th century, late | race, genetics, human variability

Postulate Theory and the Growth of American Mathematics, 1894-1945

Ellen Abrams
Cornell University

In 1932, Professor Cassius Jackson Keyser called for “the disciplining of men, women, and children in the art of ‘postulate detection.’” An essential goal of education, he believed, was to teach Americans how to find the hidden assumptions that determine every system of thought, from politics to religion to philosophy. As Adrian Professor of Mathematics at Columbia University, Keyser had spent part of his career studying the foundational assumptions, or axioms, at the heart of mathematical reasoning. While the axioms of mathematics had traditionally been regarded as “self-evident” truths, mathematicians around the turn of the twentieth century became wary of such claims and began to distinguish between “axioms” and “postulates.” Unrelated to self-evidence or truth, postulates were simply agreed-upon statements used to construct a

system of reasoning. For Keyser and other American mathematicians, postulate sets became their own field of mathematical interest tied to contemporary considerations of rigor. In this talk, I discuss how the study of postulates and their properties—like consistency (no postulate contradicts another) and independence (no postulate can be derived from another)—was used to criticize the abstract, out-of-touch practices of modern mathematical research as well as to celebrate its artistry and virtues. Overall, I situate what would later be referred to as “American Postulate Theory” within the landscape of modern mathematics as well as the early-twentieth-century growth of the American mathematics community.

Mathematics | North America | 20th century, early

Practising Medicine in Early Colonial Lima, Peru

Linda Newson
Director, Institute of Latin American Studies, University of London

The Spanish crown anticipated that the medical practices in Spain would be replicated in the New World. While there were abundant opportunities to practice medicine in Peru, the opportunities to learn

medicine were limited by the lack of universities capable of awarding medical degrees and by the shortage of books to guide students.

Meanwhile, those practitioners who came from Spain found that the *materia medica* they had traditionally used was not always available. How did medical practitioners respond to these conditions? How did they acquire training and did they experiment with the diverse flora and minerals found in the Andes? This paper shows that despite the obstacles that medical practitioners faced they tried to adhere to humoral medical practices. This extended to training indigenous people and African slaves how to prepare medicines and let blood and to seek local substitutes for Old World medicines.

Aspects of Scientific Practice/Organization | Latin America | Cultural and cross-cultural contexts, including colonialism in general | Spain, Peru, Medicine, Student Migration, Scholar Migration, Medical Practitioners, transfer of information, transfer of knowledge, transfer of skills, Colonial Cultural Context

Precision and Exactitude in the Analysis of Stellar Spectra: How Conviction and Circumstance Shaped Anton Pannekoek's Scientific Persona and Practice

Chaokang Tai
University of Amsterdam

The astrophysical research of Anton Pannekoek (1873-1960) is characterized by epistemic virtues like precision, diligence, and exactitude, which he valued over expeditiousness or scope. In theoretical research these virtues were present in his development of laborious numerical methods for the fine analysis of stellar spectra, while in observation research, they were evident in the excruciating detail with which he and his students measured the spectra of only a small number of stars. In part, his approach to astrophysics was shaped by the fact that he was an isolated astronomer without an observatory. The early twentieth century saw the founding of large photographic observatories taking on massive broad-scope cataloguing projects. To establish his own niche, Pannekoek decided to focus on the precise measurement of stellar spectra, spending years measuring only a small number of borrowed photographic plates. While

Pannekoek's adherence to precision and exactitude complied with practical constraints, it also reflected his ideas on the role of science in society. A reputed astronomer, Pannekoek was also a noted and influential Marxist theorist. In his socialist and historical writings, he emphasized that science had above all to be beneficial for society – not only by providing technological advances, but especially by exemplifying a way of thinking. From this standpoint, Pannekoek's projected self-image of an observational astronomer who focused on precision and work ethic over expeditiousness or scope coincided with the general role he envisioned for scientists in society.

Physical Sciences | Europe | 20th century, early
| astrophysics, astrophotography, scientific
persona, science and society

Predictions of the End of the World: Circulation of Astronomical Knowledge in Chilean Cultural Magazines from a Global-Local Perspective (1890-1920)

Veronica Ramirez Errazuriz
Universidad Adolfo Ibañez, Chile/
FONDECYT Chile

During the last decade of the nineteenth century and the first two of the twentieth, theories that

predicted the end-of-the-world circulated internationally and were linked to astronomers. The imminence of the end-of-the-world surpassed the fin-de-siècle atmosphere, and it remained until after the passing of Halley's Comet in 1910, which in the case of Chile was heightened by the 1906 earthquake. Our work studies the end-of-the-world predictions associated with astronomical phenomena - specifically with the passage of comets- that circulated internationally in this period, and analyzes how they were received, re-signified, amplified or counteracted in the main Chilean cultural journals between 1890 and 1920. These theories, disseminated by the press in peripheral areas such as Chile, greatly motivated the generation of local astronomical knowledge, since the inexperienced scientific reading public interpellated and demanded local experts to explain, support or criticize these predictions. The circulation of end-of-the-world forecasts from an astronomical perspective established communication networks between regional and foreign institutions, especially between astronomical observatories and journalistic companies, which read each others

works and generated an exchange of knowledge in a global manner that took into account local meanings. Our main questions are: How were the interpretations, representations and national re-significations of these theories related to the versions that circulated in global networks? What role did the local communities and institutions (observatories, government agencies, amateurs, journalistic companies, etc.) play in these global networks of circulation of end-of-the-world theories?

Aspects of Scientific Practice/Organization |
Global or Multilocal | 20th century, early |
Astronomy, Global Networks, Predictions

Preparing Princes or Who May Preserve the Ruler for Eternity?

Ulrich Schlegelmilch
Universität Würzburg

In the 16th and 17th centuries, medical students from the German-speaking territories would very often set out for Italy especially in order to gain extended anatomical and surgical knowledge. Back home, opportunities to put these additional skills into use were rather narrow, but there were some exceptions. The preparation and embalming of corpses was one of these. This was a topic that had not normally been much focused upon in physicians'

writings, but this changed by the middle of the 17th century. From an analysis of some key texts it will become clear that this shift in attention has to do with the increased estimation of surgical skills by physicians. The central item of the paper will be a didactical letter by Balthasar Timaeus (d. 1667), a physician in Pomerania, describing the act of preparing and embalming a corpse to his son, himself a medical student. Timaeus, who had acquired this advanced knowledge of instruments and techniques in Padua during his peregrinatio, passed it on among his family as a surgeon would do. Others almost at the same time did introduce the topic into academic teaching as well, which was a further step of merging the medical and surgical spheres that had, in the Holy Roman Empire, been officially kept well apart. My sources come from the "Physicians' Correspondences of the German-Speaking Territories, 1500 to 1700" project based at the Bavarian Academy of Science. They further include disputations and other

contemporary publications and excerpts on the subject.

Aspects of Scientific Practice/Organization | Europe | 17th century | Holy Roman Empire, Italy, Medicine, Student Migration, Scholar Migration, Transfer of Information, Transfer of knowledge, Embalming Techniques, Transfer of Skills, 16th century, 17th century

Priest-Pharmacists and the Domestic Medical Archive in the Heart of Paris, 1660-1730: Material Technologies and the Medical Community

Emma C. Spary

In this paper I will present a collection of secrets gathered between around 1660 and 1730 in the Oratorian house on the rue Saint-Honoré, the heart of Paris's growing culture of consumption. While the identities of receipt authors and compilers cannot often be ascertained, studying the collection as a material technology allows a focus on the intersection between curing and being cured, shopping and healing, and the relationships between medical self-help and communal medical practice. In the priestly world, such practice spanned across the charitable, domestic and commercial domains; I will argue that collective autoexperimentation allowed the performance of other categories of medical practitioner to be scrutinised

and critically evaluated. The 'paper tools' of the Oratorians show how the practice of cure—the arts of the body—depended on the ability of healers to shift knowledge between the individual body, epistolary/natural philosophical networks, books and the material object of the 'secret'.

Medicine and Health | Europe | 17th century | Auto-experimentation, medicinal secrets, self-help, paper technology

Printing Between the Lines: A Sixteenth-Century Historical Table

Ashley Gonik

History, Harvard University

Johann Funck's "Chronologia" was one of the most popular tabular chronologies of the early modern period with several editions following its original 1545 publication in Nuremberg. In my presentation, I will display an opening from the 1554 Basel edition of the same work to highlight the instability of the historical table in its printed form. I will focus on the ostensibly restrictive—but actually quite fluid—boundaries of the table's rows, columns, and cells in terms of their intellectual foundation and bibliographical construction. The printed sixteenth-century historical table is an artifact

designed to be absorbed in a glance, yet it rewards the attentive viewer who lingers and zooms in.

Thematic Approaches to the Study of Science | Europe | Renaissance | printing, historiography, chronology, tables, diagrams

Printing Science in the Princely Hyderabad: Nawab Fakhruddin Khan Shamsul Umara's Epistemological Interventions

Muhammed Ashraf Thirisseri
University of Hyderabad

This paper will analyze the epistemological interventions of Nawab Fakhruddin Khan Shamsul Umara in the field of science and knowledge production in the princely state of Hyderabad. He established a printing press in the state in 1834 and founded an institute of learning. He translated science books from English and French to Urdu language. The books were dealing with multiple subjects including astronomy, geography, biology, physics etc. Instead of passively receiving 'western science' he contested it through bringing religion to epistemological terrain and made the science/reason speak to religion/tradition in a mutually constitutive way. He played the role of a 'middleman' to introduce printing technology in Hyderabad like many other figures

in the various Muslim contexts. This paper will be an engagement with multiple questions including science, technology, religion, modernity, knowledge production and power. In order to establish connection between multiple themes this paper will utilize archival data and biography as primary materials. This paper will also examine the encounters between the British and the Nizam, the ruler of the state regarding the introduction of print in the state. Rather than analyzing the princely state of Hyderabad in opposition to British India this paper will consider it as a distinct and 'minor sovereign' space and contextualize science and technology in their socio-cultural and political backgrounds. This paper will contribute to the studies on print and science in the princely contexts as it has been neglected in South Asian studies.

Aspects of Scientific Practice/Organization | South Asia | 19th century | Modernity, Technology, Print, Science, Knowledge Production

Privileged Translations: State-Sponsored Translations in the Early Dutch Republic

Marius Buning

Dahlem Research School Fellow, Freie Universität Berlin

This essay explores the intimate relationship between translations and printing privileges in the early Dutch Republic (ca. 1581-1621). Printing privileges provided temporary monopoly rights to produce a variety of printed materials, including books, pamphlets, engravings, and maps; they are usually understood as relatively straightforward means used by printers to strengthen their economic market position. This essay argues, however, that printing privileges were equally part of the soft power machinery employed by the Dutch authorities to establish the Republic as an important state in its own right. Remarkable in this respect are the many privileges issued for translations. The essay contends that framing the system of printing privileges in political terms can help us better understand how, why, and when specific translations appeared on the market. Based on extensive and new source materials, I provide statistical data regarding the share of translations within the

Dutch system of printing privileges. I then focus on four questions: Which translations were privileged? Why specifically these books, maps, and prints? Who was the intended audience? And what was the role and status of translators in the distribution of printing privileges? The answers to this set of questions will provide a better understanding of the patterns of normativity in how translations were brought to the market in early modern Europe and will clarify their impact on the building of the early Dutch Republic in the context of the early modern cultures of knowledge.

Aspects of Scientific Practice/Organization | Europe | 17th century | translation, patent history, book history, history of technologies, normativity, Dutch Republic

Prodigious Abstinence and Nervous Consumption: Tracing Medical Discourses of Female (In)Digestion, 1651-1694

Els Woudstra

PhD Student, Rice University

The question of female self-starvation has been widely debated in the history of medicine and religion, with scholars such as Silverman (1983) anachronistically diagnosing “miraculous maids”—women who claimed to have miraculously survived without food

for extended periods of time—as early cases of anorexia nervosa. Departing from the attempt to formulate a long history of anorexia nervosa, this paper addresses the issue of female self-starvation in the context of the cultural fascination with nutrition and digestion in religious and medical-scientific discourses of post-Civil War England, particularly attending to emerging theories of nutrition and digestion, such as Thomas Willis’ theory of fermentation. Specifically, this paper closely examines three cases of female abstinence and indigestion: the case of Martha Taylor as described in Thomas Hobbes’ letters, John Reynolds’ “Discourse on Prodigious Abstinence,” and the several religious pamphlets that advertise her abstinence as a miracle; the two cases of “nervous Consumption” described by physician Richard Morton, and the case of Eve in John Milton’s “Paradise Lost,” whose inability to abstain from eating the forbidden fruit caused, I argue, the first case of indigestion in Eden. Arguing that popular and medical-scientific discourse surrounding the prodigious abstinence of miraculous maids should be understood in a larger cultural pre-occupation with

food, nutrition, and digestion—and in particular in the medical-scientific demystification of the female relation to food and digestion—this paper offers a closer examination of narratives of female abstinence and indigestion in seventeenth century England.

Medicine and Health | Europe | 17th century | nutrition, digestion, female self-starvation, anorexia, miraculous maids, theories of digestion

Psychiatry in Indian Traditional Medicine?

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University of Alberta

Ayurveda, an Indian traditional medical system is an all-embracing system of medical teachings which encompasses a number of different historical lines and layers. The term āyurveda means, literally, “the knowledge or science (Sanskrit veda) for longevity (āyus)”. There are eight branches of āyurveda. One of the divisions of āyurveda is called bhūtavidyā (studies of disorders or possessions). This paper argues that a characteristic of Indian traditional medicine, āyurveda covers important aspects of psychiatry even though like other traditional and ancients of medicine there is the absence of a distinct discipline that is comparable with psychiatry as it has developed

in Western medicine. What are those indicating factors that show the characteristics of psychiatry in āyurveda? Is there any religious connotation in those characteristics? These are the major dealing matters in my paper. Keywords: Ayurveda, psychiatry, religion, possessions, traditional

Theoretical Approaches to the Study of Science | South Asia | Cultural and cross-cultural contexts, including colonialism in general | Ayurveda, psychiatry, religion, possessions, traditional

Pupils Gone Putrid: The Moral and Intellectual Perils of Medical Peregrinations

Joel Klein

The Huntington Library

In 1624 the Wittenberg professor of medicine Daniel Sennert (1572-1637) wrote to his brother-in-law and fellow physician Michael Döring (d. 1641) expressing grave concerns about a former student who was peregrinating from university to university and denigrating Sennert's reputation wherever he went. The situation was so disturbing that Sennert reported he was losing sleep and that his dreams had been invaded by the traitor's antics abroad. The student in question was Friedrich von Monau (1592-1659), son of the famous Calvinist

polymath and jurist Jakob Monau (1546-1603), and reports of his behavior occupy a striking portion of Sennert's and Döring's correspondence throughout the 1620s. Beyond commenting upon their intellectual disagreements with Monau, and especially his manner of writing in his dissertation, Sennert and Döring critiqued his extravagant and profligate lifestyle, even down to his manner of dress, which they regarded as all of a piece with his adoption of foreign learning. The two physicians' agitations about this student illuminate some of the challenges that arose from increasing cosmopolitanism among students eager to demonstrate international credentials. The episode reveals concerns about the national identity of medicine during the infancy of the medical Republic of Letters and highlights several major boundaries between divergent medical factions, showing how these ran along intellectual but also social, moral, and confessional lines.

Aspects of Scientific Practice/Organization | Europe | 17th century | Medicine; Chemistry; 17th century; Holy Roman Empire; Republic of Letters; Daniel Sennert; Friedrich von Monau; Michael Doering; Student Migration; Scholarly lifestyle; Student Culture

Quantifying Uncertainty: The Failure of the First World Business Barometer

Laetitia Lenel

Humboldt-University Berlin

At the end of World War I, when the idea of a “world economy” took shape, economists on both sides of the Atlantic embraced the dream of establishing an economic world barometer. The seemingly mechanical working of new forecasting instruments seemed to allow for that dream to become reality. This paper investigates the cooperation between the members of the so-called Harvard Committee on Economic Research and European economists and statisticians in the 1920s. In 1919, the members of the Harvard Committee presented an index to the public, which promised to allow for the prediction of business conditions 4-10 months ahead. Fostered by the League of Nations, which actively promoted the expansion of the index in Europe and beyond, economists and statisticians all over Europe attempted to adopt the index in their respective countries, hoping to eventually establish a world barometer. The attempts and various meetings between American and European researchers, however,

quickly revealed difficulties in adapting the barometer to other countries. Telling the story of the failure to create the first world barometer, the paper sheds light on the ambiguity between a global economy and various national economies that still lingers today.

Social Sciences | Global or Multilocal | 20th century, early | Economics, business cycle, Harvard University, quantification

Queens and Genes: Making Knowledge of Microbial Resistance

Andie Thompson

University of Amsterdam

In microbial worlds, resistance is the response to selective pressures such as antibiotic environments. To understand microbial resistance scientists are acting as multispecies ethnographers seeking to narrate microbial worlds and tell the story of how and why microbial communities emerge as resistant. Microbial resistance as an object of study is called the resistome- the collection of genes within any given community of biota that encodes various abilities to resist and their mobilization potential within and across habitats. As a metaphor for understanding this process resistome scientists are thinking with the Black Queen Hypothesis (Morris et al,

2012), a reductive evolutionary theory premised on the card game Hearts to unpack mechanisms and practices used by microbial communities. While this knowledge is key in devising “next-generation” antibiotics for human consumption it also travels from the lab to do work in other spaces, such as in agricultural biotechnology where resistance has productive capacities. In this paper I follow the theories used by scientists to understand microbial evolution and the methods used to make microbial interactions knowable to tell the story of antimicrobial resistance as a microbial technology. Drawing on the work of resistome scientists, I will describe how “living with resistance” becomes an entangled pathway of queens, genes, and future imaginaries in complex ecological and agricultural systems.

Biology | Global or Multilocational | 21st century
| Microbiology, Resistance, Antibiotics,
Modelling, Agricultural Science

Raising a Well-Grown Child: Material and Media Cultures of Normal and Pathological Childhood

Felix Rietmann
University of Fribourg

During the 19th century children moved into the focus of a

blossoming material and media culture. A growing market of parent advice literature, newspapers, and magazines offered information on topics ranging from baby care and nutrition to social and moral education. An increasingly broad range of toys and educational devices, such as baby walkers and writing helps, sought to assist and discipline the child during learning. While this vivid material and media culture has obtained some attention from scholars in the history of childhood, it has hardly been exploited as a source basis for the history of science and medicine. Yet, this paper argues that the evolving media and material culture of childhood is of considerable importance for understanding how the child became a subject of knowledge. Notably, a focus on media allows tracing how ideas about normal and pathological development were gradually articulated in the public sphere and thus sheds light on the conditions under which children could move into the focus of scientific inquiry. The paper will concentrate on newspapers, medical and scientific journals, and trade magazines in central Europe (German speaking lands and Switzerland) in the early

to mid-nineteenth century and explore how children gradually became ‘children of science’ and medicine.

Thematic Approaches to the Study of Science | Europe | 19th century

Re-Examining Culianu: Cardano, the Roman Inquisition, and the Power of Spirits

Jonathan Regier
Ghent University, FWO

Girolamo Cardano writes of how people can find themselves in love against their will: if we imagine something beautiful, we cannot withhold our love. Hence, when a beautiful form enters the imagination, the will can be submitted through the inflammation of medical spirits (Cardano then goes on to discuss the vagaries of erectile dysfunction). In 1570, the Roman Inquisition put Cardano on trial and began compiling censor reports on his works. The above passage did not go unnoticed. A prominent censor identified it as heretical, saying that the will was not necessarily carried toward anything, however beautiful, except God when He was clearly seen. Only God, it seems, has the true power of the beloved. Above, there emerge a number of themes stressed

by Culianu in his examination of Ficino, Bruno, and the repression of fantasy during the Reformation and Counter-Reformation. In my talk, I would like both to extend and criticize that reading by applying it to Cardano, showing how his natural philosophy offers a highly naturalized, medicalized reception of Ficino, one very different from Bruno’s. Here, the question of managing desire and its effects becomes an issue of understanding how elemental substances circulate through nature and the human body. I will then suggest that Cardano’s Inquisition trial can help us better understand the Reformation and Counter-Reformation’s opposition to techniques of imagination. This opposition was not due to a denigration of nature, as Culianu believed, but instead to a reaffirmation of divine providence over nature.

Physical Sciences | Europe | Renaissance | Girolamo Cardano, Renaissance medicine, Renaissance natural philosophy, Roman Inquisition, sixteenth-century medicine, sixteenth-century natural philosophy

Reading Skulls: An Object-Based Study of the Vrolik Collection of Racial Anthropology to Determine a Change in Focus of Collecting, 1800-1860

Laurens De Rooy

Museum Vrolik, Amsterdam University
Medical Centers

In the history of nineteenth-century collections of racial anthropology, a shift is detectable in the way in which skulls were collected and described. Late-eighteenth century and early-nineteenth century collections-- like those of Blumenbach-- are typological in the sense that certain races or types were represented by only one or a few skulls and, as such, these skulls came to be the 'ideal' representatives of those races. Due to positivism and objectivism, a more quantitative or craniometrical approach took over in the late nineteenth century. The aim was to collect as many skulls of a certain race or group and to take as many measurements as possible. The nineteenth-century craniological collection of Amsterdam anatomists and collectors Gerard Vrolik and his son Willem Vrolik was brought together between 1800 and 1860. In theory, the collection history may demonstrate the shift from the typological towards the

craniometrical. The main problem with the collection is that its catalogue, written at the end of Willem Vroliks life, gives us only sparse information about the years of entry of individual skulls or other information regarding provenance. However, by using the actual skulls as historical source – the different styles and systems of numbers and labels on their surface and their stands-- I argue that a shift in focus within its 60 years of collecting did occur and can be observed. This object-based study is thus not only of value with regard to specific provenance research, it is also an example of the role it may play in determining broader historical questions.

Biology | Europe | 19th century | anthropology, craniology, collection, material culture, museums, the Netherlands, classification, objects, race, anatomy

Reconstructing Human Faces from DNA: Competing Methodologies and the Quest for Replicability

Irene Pasquetto
Harvard University

Forensic DNA Phenotyping (FDP) technologies aim at reconstructing the face of a suspect from samples of DNA left at a crime scene. Law enforcement agencies employ FDP-

generated “DNA Snapshots” of suspects in their criminal investigations, and share these with the media. Scholars expressed skepticism towards the “science” behind FDP. Clinical researchers argued that the methods upon which FDP are based on are hardly replicable and do not meet the scientific standards for validity and reliability (Hallgrimsson et al., 2014). Anthropologists pointed out that FDP-generated portraits are racially biased, and warned against the ethical issues related to their rapid diffusion (M’charek, 2017). Meanwhile, novel approaches to reconstructing faces from DNA samples keep emerging. In February 2018, an international team of physical anthropologists and computer engineers published on *Nature Genetics* a novel methodology that aims at addressing past criticism (Claes et al., 2018). Central to this novel methodology is the use of phenotypic and genotypic data from genome-wide association studies (GWAS), and of machine-learning algorithms for the calculation of facial phenotypes. Drawing on ethnographic research and document analysis from early 2000s to present days, this paper narrates the emergence of data-

driven methodologies for DNA-based facial reconstruction, and examines the rationales behind their adoption as the new standard for replicable research on DNA-based facial reconstruction. Most importantly, the paper highlights the persistence of arbitrary choices made by the researchers in defying facial phenotypes over the years and throughout different methods, including novel data-driven approaches.

Technology | North America | 21st century |
Forensics, Clinical Research, Race, Ethics,
Algorithms

Reconstructing the Medical Canon: Seventeenth-Century English Physicians and Their Notebooks

Sietske Fransen

Bibliotheca Hertziana, Max Planck Institute
for History of Art

Based on two collections of personal notebooks I will investigate the role of translation in the re-creation and reconstruction of the medical canon in seventeenth-century England. One of the results of the so-called “scientific revolution” on the traditional medical corpus was that classical medicine was re-framed and interspersed with vernacular, practical, and local knowledge. The medical practitioner John Ward

(1629-1681), an Oxford man, left seventeen volumes of 'diaries' in which he recorded what he read, with whom he spoke or corresponded, and in which he noted down medical practices and recipes. A contemporary of his, the physician Daniel Foote (1629-1700), had trained in Cambridge. Foote left more than thirty-five volumes of notebooks, giving an insight into his university education and his many different interests and occupations. The Ward volumes, which have been described before, will form the context in which Daniel Foote's collection will be analysed. Foote's notebooks contain many extractions from canonical texts both in Latin and translated into English, but they also contain translations, from Latin, German, Dutch, and French lesser-known texts into English. Apart from textual translations the volumes also contain books of tables, summarizing and visualizing classical and vernacular medical information into manageable portions. By comparing the note-taking practices of these two medical practitioners, this talk will make clear how translation of texts and practices from a variety of

sources was essential in building a new medical canon.

Medicine and Health | Europe | 17th century |
Medicine, University, Canon, Notebooks,
England, Europe.

Reconstructing the Nation: The German Institute for Norms

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The German Institute for Norms (later called DIN), founded in 1917, ostensibly aimed to first fuel wartime production and later restart the German economy after the lost war. By prescribing dimensions and shapes for mass produced objects, engineers and architects constructed an entire norm system scaffolding their main ambition: to save time and resources as response to the post-WWI scarcity and mounting economic crisis. This paper will investigate the different temporalities and ideologies embedded in the production of these norm sheets. One was the engineer's projective vision not just of future normed objects, but of an entire nation constructed from (and through) fitting parts. Another the interplay between the idea of the norm system as permanent precisely through timely change of its parts due to anticipated technological

advancements. And lastly, the norms were a compression of historical and professional layers, filtered through multiple institutional layers of committees and experts, to eradicate subjective authorship in favour of "neutral" technological advancement. The search for the best measure systems, units and representational techniques, an analysis of the attempt to standardize transparency and frictionless production will be foregrounded by the struggle for territorial control and national expansion through bureaucratic means.

Thematic Approaches to the Study of Science | Europe | 20th century, early | norms, social engineering, standardization

Redistributing the Resources for Intellectual Work: Ernest Solvay's Energetic Sociology and the Call for Inheritance Taxation

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ETH Zurich

Since the establishment of the laws of thermodynamics, the allocation and efficient use of energy resources has not only been a major topic for the physical labor of man and machine. Around 1900, the efficient use of energetic resources presented an equally important issue for establishing techniques and policies

fostering mental and intellectual labor and thus for advancing science and innovation in society. One of the proponents promoting research on the energetic conditions of mental labor was the inventor and entrepreneur Ernest Solvay. Besides his well-known institute of physiology, Solvay also founded the Institut des Sciences Sociales in Brussels in 1894 which was succeeded by the Institut de Sociologie in 1902. Based on empirical research both institutes were meant to develop measures and legislative policies against social inequality. One crucial field of research was the role of progressive inheritance taxation in redistributing the resources of wealth and in this way changing the future opportunities of intellectual work. The paper will relate the small-scale perspective of the physiological research on the energetic conditions of individual mental labor at Solvay's institutes both to his activities in promoting the social sciences as a big-scale perspective on "social energeticism" and to his political advocacy of redistributing the resources for intellectual work

on the long term by means of progressive inheritance taxation.

Social Sciences | Europe | 20th century, early | energy, labor, social sciences, taxation

Regional Universals: The Ecologies of the International Union for the Protection of Nature, 1950-1960

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After World War II, the global conservation community went through a period of institutional restructuring – which culminated in the foundation of the International Union for the Protection of Nature (IUPN, later IUCN) in 1948. From the start, ecology served as the lead science of the new organization. Several prominent voices within IUPN believed that ecology's universal laws would give coherence to the Union's program. Yet, when in the 1950s IUPN members finally got new conservation projects off the ground, it quickly turned out that ecology could inspire very different approaches. In the Middle East, the Union's ecologists became involved in highly interventionist and utilitarian programs that ultimately aimed to 'make the desert bloom'. In Western Europe, then, IUPN members focused on the protection

of historical landscapes such as heath and moorland – which they conceptualized as a valuable form of 'half-nature'. And in sub-Saharan Africa, finally, ecology-led conservation aspired to maintain a 'pristine' wilderness that was seemingly devoid of human influence. In this paper, I will explore the ambiguities of IUPN's 'global mission' of the 1950s, and explain why – despite a universalizing rhetoric – its ecological program would give rise to such divergent regional approaches.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, late | Conservation, environmental science, transnationalism, localism

Regulating for a Culture of Care: British Animal Research Legislation in the 1980s

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'Laboratory animals' and the infrastructure that sustained them were an integral part of the development of the twentieth-century biological and biomedical sciences. Until 1986, in Britain, the scientific use of animals was governed by the 1876 Cruelty to

Animals Act. For 110 years—during a period of rapid techno-scientific change and exponential expansion of the biomedical sciences—a core part of twentieth-century scientific activity was shaped by Victorian legislation. This paper charts the reform of animal research governance in late twentieth-century Britain, exploring the social and scientific factors that shaped new legislation culminating in the 1986 Animals (Scientific Procedures) Act (ASPA). Intended to balance the interests of scientific organisations, professional bodies, and animal welfare advocates, ASPA was driven by a combination of scientific recognition of the importance of standards of animal care and a societal re-invigoration of animal advocacy politics. By drawing on oral history interviews with animal technologists and veterinarians, as well as the recently opened Home Office records, we chart how ASPA contributed to the ‘professionalization’ of care, examining how emergent knowledges and practices of animal care informed the new legislation and were subsequently transformed by it. In doing so, we explain why veterinarians and ‘animal technologists’, absent in the original

1876 legislation, were ascribed prominent roles within ASPA as adjudicators of the needs of science and those of animal welfare. In conclusion, our paper reveals the conditions which allowed care to operate within the experimental sciences to productively align scientific and societal values.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | animal research, biomedicine, care, technicians, science regulation

Relocating the Neurosciences and Decentering Euro-America: The Ibadan Neurosurgery Clinic and The Evolution of Antiracist-Decolonized Neuro-Oncology and Egalitarian Styles of Thinking on Intracranial Neoplasms in Africa and the United States

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During the first half of the twentieth-century, neurosurgeons in the US linked differential experiences of brain/intracranial tumors such as meningiomas, gliomas, lymphomas, pituitary adenomas, and craniopharyngiomas to biological difference. In 1937, for instance, Harvey Cushing wrote that “brain tumors of any kind were rare in negroes.” Having seen only four

meningiomas out of some two thousand brain tumors in his practice, Cushing concluded that negroes were exempt from meningiomas because their skulls were denser and thicker than those of whites. But differential incidence of brain tumors was not only racialized, but also gendered and geneticized; the latter especially in the 1970s by pathologists like Joseph Kovi and Kenneth Earle. However, by the last quarter of the century, a more egalitarian style of thinking on intracranial neoplasms would evolve in the US, which held that these neoplasms also affected negroes. My paper argues that the evolution of this new knowledge was not an exclusively US production, but drew extensively on the knowledge produced on intracranial neoplasms by African neurosurgeons, neurologists, and pathologists like Latunde Odeku and Adelola Adeloye during the period 1960s-1980s. It examines the why and how of the production and circulation of this style of thinking from Africa to the US. Thus, by locating the evolution of this new style of thinking not in the United States, but in Africa, and paying attention to the contributions of non-Western actors to western

knowledge production, my paper, contributes and extends the new scholarship on global perspectives on science.

Medicine and Health | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general

Responsible Selves: The Popularization of the Calorie, Scientific Expertise, and Citizenship in Early 20th Century US

Nina Mackert
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The paper discusses the history of the food calorie as a case study for the popularization of scientific expertise as an ambivalent process of responsabilization. When chemists introduced the calorie to Americans in the last two decades of the nineteenth century, food and bodies became quantifiable unlike ever before. In the early 20th century, calorie counting became popular as a weight-loss method among the white middle class, suggesting that individuals could and should determine their calorie needs and manage their food intake and body weight accordingly. Drawing on popular expertise and personal accounts of dieters, the talk highlights a core ambivalence of self-tracking. On the one hand,

modern possibilities of quantification created the self-responsible, enlightened subject who could be his/her own expert. In contrast to earlier forms of weight-loss dieting, calorie counting promised to grant individuals the liberty to choose their foods themselves and to diet on their own authority. On the other hand, the “avalanche of numbers” (Hacking) emerging from modern sciences since the nineteenth century was a crucial part of a biopolitical governmentality subjecting bodies to a new, scientifically authorized, regime of truth. By suggesting that body shape was precisely manageable through calorie counting, the calorie located the responsibility for health and weight within the individual and contributed to creating powerful norms of proper eating and body shape. In times when taking care of one’s body became a litmus test for citizenship, the calorie shaped who was acknowledged as a responsible member of society.

Thematic Approaches to the Study of Science | North America | 20th century, early | calories, medical history, history of the body, expertise, self-tracking

Revisiting Wilhelm Ostwald’s Nobel Prize in Chemistry

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The historical narratives on the Nobel Prize in Chemistry granted to the Baltic-German chemist Wilhelm Ostwald (1853-1932) hardly address the strong support Ostwald received nor the reasons presented in their nomination letters. Considering to be relevant presenting the reasons behind Ostwald’s prize, in this work we present and discuss the nomination letters sent in Ostwald’s favor in Nobel Prize editions between 1904 and 1909. Analysing these letters and dialoguing with the literature, we argue that, for Ostwald’s supporters, his most relevant achievements concerned his extra-laboratorial activities, namely his role as a teacher and organizer of chemical science. We will also attempt to demystify some frequent discourses on Ostwald’s nomination, such as the negative influence of his antiatomist posture and the central role of catalysis for his nomination.

Chemistry | Global or Multilocational | 20th century, early | Wilhelm Ostwald, Nobel Prize, Nomination letters.

Roger Bacon's Scientia Experimentalis as Technological Manipulation of Nature in Premodern Europe

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Roger Bacon's *Scientia experimentalis* is driven by a new apocalyptic Christian vision of reform and renovation on earth. It involves the manipulation of light and sight in the production of new technologies of war. It involves a new vision of Chemistry/ Alchemy in the renovation of the human body. Since the body is closely united to the intellectual soul, in a non-Platonic manner, the material, physical world is taken up and transformed in a renewed human world in its return to the divine. This Re-creation of life is the reditus side of the original creation.

Physical Sciences | Europe | Medieval |
Theology, alchemy, Roger Bacon, Experimental science, Creation

Same Story, Different Setting: Using Goiter to Understand Calls for American Science at the Turn of the Nineteenth Century

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Sewanee: the University of the South

In 1800 American physician Benjamin Smith Barton (1766-1815) published a book-length treatise

titled on goiter and North America and dedicated it to his friend and mentor Johann Frederick Blumenbach (1752-1840). Within its pages Barton takes the seemingly niche topic of goiter or "swelled neck" and makes an elegant case for the pursuit of science in the United States. While many scholars have rightly pointed to the patriotic arguments Americans made for promoting scientific, Barton's work goes beyond such concerns. In addition to political and professional standing American men of science believed that their unique situation could bring novel information to the world stage, not as an abnormality but a key point on a continuum. Barton's book suggested that a lack of American knowledge could allow for the perpetuation of errors in the scientific literature. By the late eighteenth century goiter was a disease of the mountains. Theories differed as to what exactly caused that ailment but medical and travel literature agreed that inhabitants (especially female inhabitants) of mountain valleys were threatened by goiter and the associated mental defects of "cretinism". Barton's personal travel and accounts from colleagues in the United States, however, proved North American

goiter to be a western (yet still female) disorder regardless of elevation. The book therefore acts as a corrective to European literature claiming that study of a disease in one location is not sufficient to make universal claims. In an era of universal concepts Barton made the case for American inclusion.

Medicine and Health | North America | 19th century | Medical Topography, Goiter, Benjamin Smith Barton,

Science and Engineering Education at IIT Madras: Indian and German Perspectives and Practices in Conflict

Roland Wittje

Indian Institute of Technology Madras

The Indian Institute of Technology (IIT) Madras was set up with West German assistance between 1959 and 1974. From its beginning, Indian and German actors differed in what kind of engineering school IIT Madras would be and hence how its engineers should be trained. The Indian planners envisioned IIT Madras to be an MIT-like research university while the German planners insisted that Indian engineers needed largely practical training. Through the 1960s, the nature of the German engagement became more research oriented with competition from the other IIT's but

the critique of German faculty remained: Indian engineering training was too theoretical and lacked practice. In my presentation I want to unpack different understandings of practice and how they relate to a larger discourse on science, technical education, the caste system and colonial legacies in India. The critique of practice deficiency was not an argument between scientists on one side and engineers on the other, as it was shared by all German professors. The physicist Werner Koch, for instance, who had studied with Robert Pohl in Göttingen and had worked in the electrical industry, wanted physics teaching for engineers to be largely practice-oriented. Koch introduced Pohl's textbooks as well as Pohl's lecture demonstrations to IIT Madras. Koch's call for "re-educating" Indians, I argue, was informed by a narrow understanding of educational transfer from Germany to India that ignored social differences and hierarchies on both sides.

Aspects of Scientific Practice/Organization | South Asia | 20th century, late | Engineering education, Indo-German collaboration, practice

Science Diplomacy and the Epistemologies of Ignorance: The Nuclear Accident of Palomares (Spain, 1966)

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Different authors have highlighted that invisibility, doubt or ignorance are not natural states of the population, simple absences of information or knowledge, but the outcome of active and effortful cultural and political processes. This paper argues that science diplomacy has played a crucial role in the processes involved in making invisible nuclear risk. To do so, it focuses on a nuclear accident that took place in Spain, 1966. Four nuclear bombs fell onto a town on the South coast, Palomares, due to a crash between two US Air Force planes. Two of the bombs leaked their radioactive content contaminating wide areas of the territory. I will argue that a key part of the diplomatic strategy adopted to solve this crisis focused on making invisible radiation risk in the public domain. Minimizing public attention to the accident was listed, in scientific and military reports of the accident, as a strong argument during diplomatic negotiations. It

justified decisions regarding radioactive protection of the inhabitants and security measures of the clean-up actions. The public campaign to render nuclear risk invisible influenced the popular perception of nuclear risk, but not only this: it also had epistemic effects. The criterion of minimizing public attention shaped also the negotiations on levels and methods of decontamination. At the diplomatic table, scientists from US and Spain had to agree on the decontamination methods and on the levels at which various types of decontamination actions would be taken.

Aspects of Scientific Practice/Organization | Europe | 20th century, late

Science Diplomacy on the Road: The IAEA's Mobile Laboratory Travels to Greece

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This paper focuses on the technical assistance programs of the International Atomic Energy Agency as both the beginning and the embodiment of modern science diplomacy. According to its statute, the Agency, a political and diplomatic international organization within the United Nations system,

was authorized to provide technical assistance to those Member States that required it. This paper brings front and center the case of Greece and unravels the complex negotiations between the Greek Atomic Energy Commission and the International Atomic Energy Agency. To do so, we follow the first Mobile Laboratory on its maiden trip from Austria to Greece and scrutinize the negotiations that took place among central actors in our case. The mobile lab was one of the two laboratories that the US government donated to the IAEA for the technical training of new physicists on the use of radioisotopes in medicine, agriculture and industry. From 1959 to 1965, the two units visited sixteen countries in Europe, Asia, Africa and South America and approximately 1500 technicians and students attended training courses. We argue that the laboratory's trip to Greece was much more than a scientific effort to develop the country's nuclear program. It had the additional diplomatic mission to enlist Greece as an ally of the western bloc. Without doubt, the case of Greece demonstrates that the IAEA's technical assistance, as it was carried out through the Mobile

Labs Program, was not just a moment of international scientific cooperation but it was essentially an aspect of scientific diplomacy.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, late | science diplomacy

Science Diplomats: A Hybrid Role in the History of the Greek Nuclear Program

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Focusing on the case of Greece, this paper examines the way nuclear science was introduced to developing countries during the 1950s as part of Cold War political processes. Through the Eisenhower's "Atoms for Peace" program and before the establishment of the International Atomic Energy Agency, the United States sought to maintain and expand its post-war hegemonic position, restructuring Europe as a bulwark against the perceived Soviet threat. The proliferation of nuclear physics and technology, especially in the developing and contested political regions was an effective instrument of soft power to this end. In the case of Greece, the installation of the country's first research reactor and the

establishment of the nuclear center Demokritos, was a complex diplomatic affair between two unequal countries in terms of their diplomatic armamentarium. On the one hand, the United States had a well structured diplomatic activity and developed scientific capital. On the other hand, Greece was just getting out of a fierce civil war having little scientific activity and complex diplomatic practices. Thus, the process of developing the Greek nuclear program emerged as an idiosyncratic practice of science diplomacy. Significant milestones such as the Greece-US bilateral agreement or the choice of the most appropriate nuclear reactor for the newly established center were determined by individuals who took up the role of science diplomats. I argue that these individuals constituted a special kind of science diplomat who, while being neither scientists nor diplomats, acted as such determining in a decisive way the country's scientific development.

Aspects of Scientific Practice/Organization |
Europe | 20th century, late

Science Fiction Meets Reality: Hannes Alfven's 1966 Vision of Future Computers

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A few programmable computers existed already in the 19-thirties and forties. Around 1955, larger numbers of commercially produced computers became available. In the years 1968-1974, researchers working in different fields of mathematics and physics met at international conferences with titles like 'Computers in Mathematical Research' (1968) or 'The Impact of Computers on Physics' (1972). To my knowledge, the Swedish-American plasma physicist Hannes Alfven (1908 - 1995) did not attend any of these meetings. Also, he did not mention computers in his Nobel Lecture in 1970. Under the pseudonym Olof Johannesson, however, he published a science fiction story about the future impact of computers, in Swedish (1966), English (1968), and in German (1970), describing how the development of computers did lead to a global world society in which everything is automated and organized by computers. Finally computers even reproduce

themselves and some computers service the others and prevent the whole system from breaking down. It is amazing to read this text today: some of Alfven's predictions did become real in the meantime, others are still desirable for the future, and others are a strong warning or clearly a satire. It is unclear how much Alfven's booklet influenced the development of technology and society. In Germany, Klaus Brunnstein (1937-2015) used it in 1973 to start a public discussion about the future role of computers. Brunnstein (computer scientist, politician and IFIP officer) had strong influence on German legislation with respect to IT security, social accountability and information privacy.

Technology | Global or Multilocal | 20th century, late | science fiction, automation, impact of computers on society, IT security, information privacy, social accountability

Science Parks and Instant Villages: Postmodernism and British Telecom in Thatcher's Britain

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This paper explores the aesthetic of 'place' and the emergence of science parks in the 1980s through a study of British Telecom Labs in

Martlesham Heath, rural England. Above BT Labs' entrance is a plaque engraved with 'Research is the Door to Tomorrow'. BT Labs inherited the plaque from its predecessor, the Post Office Research Station, which BT acquired in 1981 after Margaret Thatcher created BT to take over the British telephone system from the Post Office. The research centre was a modernist, corporate lab, designed to emulate the 'industrial Versailles' of Bell Labs and General Motors' Tech Centre, but in the 1980s, amidst a Thatcherist vogue for science parks, it became 'Austral Park', a 'science campus' whose name referenced the motto of the Royal Air Force, deliberately evoking Britain's WWII spirit. Austral Park, however, is not Martlesham Heath's only distinctive feature. From 1975, with the promise of new residents from research staff, an 'instant village', built like an 'unspoiled traditional village', was built on the heath, a postmodern reaction in architecture and town planning against post-war Britain's 'new towns'. Martlesham Heath has multiple, contradictory expressions of temporality, and in this paper I argue that the evolution of this corporate laboratory, from

modernist Post Office Research Centre to Thatcherist ‘science park’ experiment, invoked history and futurity in ways that turned ‘Martlesham Heath’ from a heathland space into a ‘place’ in its own right, with a past, present, and future.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | research laboratories, science parks, postmodernism, Thatcherism

Science Policy in Portugal: The Instituto Nacional de Investigação Científica (INIC)

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Like many of its European counterparts, the Portuguese Scientific System went through a radical transformation throughout the 20th Century. To a limited extent, these changes were a response to some internal pressures (Higher Education and Colonial Enterprises) and in tune with the international/European tendency for the development of transnational policies and practices. These transformations accelerate from 1976 onwards, with the Carnation Revolution (1974), when the country transitioned from the Estado Novo fascist regime to a democratic system. These transformations were

shaped by a plethora of State Institutions with distinct missions and objectives (often overlapping or conflicting) through a very dynamic and complex process which ran parallel with the maturation of the Portuguese democratic political system. In my dissertation, I follow one of these institutions, the Instituto Nacional de Investigação Científica (INIC), that, in light of the Actor-Network Theory Framework can be seen, not as a mere intermediary, like current historiography portrays it but, as an influential mediator, deeply entangled and influential in the complex institutional dialogue from which the present Portuguese Scientific Research System emerged.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | Science Policy, Portuguese Scientific Institutions

Science Reigns Supreme: Conceptualising Public Science in the Illustrated London News

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The Illustrated London News (ILN) published a regular column on science in society from the late 1880s. Titled under various labels, “Science Jottings”, “Science and Natural History”, “The World of

Science”, this column sought to provide the British public with a scientific engagement of the world around them. From the late 1880s to 1946 the column was written by five men, curating the scientific knowledge of the ILN’s readership. The first editor, Dr. Andrew Wilson, wrote in April 1906 that “Science reigns supreme” given the “widespread range of interests ... with which she is largely concerned”. Wilson’s claim was that science proliferated into every tendril of society and was indispensable to present-day living and it was the column’s mandate to detail how. In order to cover the vast expanse of science, topics jumped from crime one week to morals the next followed by noise and dust. This paper explores the ILN’s science column from the late 1880s to 1946 to understand how five science editors defined and mapped out the contours of the concept of “science” in the British public in a haphazard and undirected manner. The ILN was one of the most read periodicals in the nineteenth and early twentieth centuries, providing a good case study for exploring the spread of scientific knowledge in society. At the core of this paper, I reflect on the role of periodicals in

disseminating “soundbites” of science and the “chatter” they created at the beginning of the twentieth century.

Tools for Historians of Science | Europe | 20th century, early | Popular Science, Newspapers, Public Engagemnt

Science, Democracy, and the Pursuit of Aliens

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In 1902, a contributor to Popular Science affirmed that “The era of the amateur scientist is passing; science must now be advanced by the professional expert.” Throughout the twentieth century, amateurs have been increasingly excluded from the production of scientific knowledge. But since the 1990s, under the banner of “citizen science”, a growing number of initiatives have involved, once again, amateurs in science, with the goal of democratizing science, promoting scientific literacy, and solving big data problems. The creation of SETI@home at UC Berkeley in 1998 embodied all these aims. Within six month, it had attracted more than one million participants analyzing radio signals from space on their personal computer searching for signs of extraterrestrial life. The

initiators of the project and the media constructed the image of the participant along the lines of an imagined amateur scientist making discoveries outside of scientific institutions, while contributing to the making of a global scientific citizenship. Infused by libertarian, countercultural, and cyber-utopian ideals, SETI@home seemed to capture the scientific aspirations of a new generation. But the tens of thousands of online biographical sketches left by the participants present a more nuanced picture. These traces offer a unique window into the self-fashioning of the participants into different kinds of “amateurs”, “volunteers”, and “hobbyists” with various views about professional science and its place in society. These sources help us better understand the recent reconfigurations of the amateur scientist and, more generally, the struggles over the legitimacy of professional expertise.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 20th century, late |
citizen science, public participation, expertise,
democracy, computers

Science, Falsely So-Called? Pseudoscience, Anti-Darwinism, and the Science-Religion Debate at the Victoria Institute

Stuart Mathieson
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By the mid-nineteenth century, works by scientists such as Charles Lyell, Alfred Russel Wallace, and Charles Darwin had threatened traditional conceptions of the natural world, drawn heavily from scripture and from the natural theology of William Paley. Much attention has been paid to debates with the scientific community about evolution, human origins, and the age of the earth. Yet much of this has concentrated on the rapidly professionalising area of the natural sciences in academia. Debates within other fields, particularly those of well-educated amateurs, have received rather less attention. This paper attempts to remedy that situation, by examining the nineteenth century's leading anti-evolutionary organisation.

Established in 1865, the Victoria Institute had as its prime objective the defence of ‘the great truths revealed in Holy Scripture’ from ‘the opposition of science, falsely so called.’ Bringing together professional scientists, clergymen,

and gentlemen amateurs, the Victoria Institute aimed to investigate the latest developments in science from a religious perspective. Initially, this resulted in attempts to buttress religious belief against scientific discoveries; later, it developed into an opportunity for scientists of faith to discuss their beliefs with a sympathetic audience. Drawing on lectures delivered at the Victoria Institute, correspondence, and proceedings, this paper charts the relationship between religious belief, anti-Darwinism, and pseudoscience in Victorian Britain and Ireland and offers a perspective on scientific developments from an underexplored viewpoint.

Thematic Approaches to the Study of Science | Europe | 19th century | Science and religion, Darwinism, Baconianism

Scientific Animations: Filmology, Experiment, and the Human Sciences

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Just after the Second World War, a large interdisciplinary group of scientists from all over Europe and some of overseas, joined efforts to found a new science called Filmology. The war had demonstrated the pervasive effects of film as a propaganda tool, on both

sides of the conflict. These scientists were convinced that it could no longer suffice to study film as an aesthetic phenomenon: it had to be studied also as a psychological and social phenomenon. Mobilizing all existing human sciences, they tried to develop scientific methods to study the effects of film on man and society. Several of these Filmologists tried to bring the complex problem of cinema to the laboratory. Here, often the use of animation film was promoted, in an attempt to obtain scientific control on the elusive medium of film. Experimental psychologists such as the Belgian Albert Michotte and the British Frederic Bartlett took a leading role. In this paper, I study the history of animation as a shared history of science and media. I explore the use of animation as a scientific experimental tool and examine what its role in these experiments can tell about the changing notion and practice of experiment in the post-war human sciences. The Filmology episode shows how closely media and science have been intertwined: how scientists have investigated media, and how this study of media has challenged their experimental practice. When telling the stories of

science, science's animations, as abstract and short as they are, are worth showing.

Aspects of Scientific Practice/Organization | Europe | 20th century, late | History of Science and Media, Instruments and Experiments in Art and Science, Material and Sensory Cultures of Science, Moving Images in Science, History of Techniques, History of Psychology and the Human Sciences

Scientific Archaeology: Materially Linking Humanities and Sciences since 1880

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The sciences and the humanities have not only been sharing practices, concepts or epistemic virtues with one another, they also cooperated in a concrete, practical and material way. Around 1880, scientific archaeology emerged. In several instances, "historians of material culture", meaning archaeologists, orientalists, (art-)historians and paleographers, and scientists shared a research interest in archaeological objects and the material analysis thereof. Objects excavated during nineteenth-century colonial expeditions shifted the research focus of historical disciplines towards material sources. The materiality of artefacts held information about the object's date, origin and manufacturing. However,

material analysis required scientific methods. What is still largely unknown, is that historians therefore cooperated with chemists or botanists, who e.g. microscopically analyzed plant fibres in ancient manuscripts or Babylonian enameled tiles, and thus were able to answer historico-cultural questions about ancient civilizations lacking textual sources. My project investigates cooperations between the aforementioned disciplines in terms of their formation and development in German speaking countries from 1880-1930. Using two examples of cooperations, between paleography and botany and assyriology and chemistry, I will uncover cooperative networks and transfer of knowledge among cooperators. In addition, through the analysis of the actor's research objects (such as paper samples) and the construction of the scientific methods applied to them, I explore the cooperations' underlying shared practices of knowledge organization, knowledge production, and innovation processes. Generally, my case studies provide insights into the dynamics of cooperative research across disciplinary boundaries

between the sciences and the humanities around 1900.

Tools for Historians of Science | Europe | 19th century

Scientific Cooperation and Asian Socialism: Chinese Ambitions and Regional Cooperation in the 1964 Peking Science Symposium

Gordon Barrett
University of Oxford

The 1964 Peking Science Symposium was the largest international scientific congress held in the People's Republic of China during the Mao Era. This event was the centrepiece of China's strategic pivot in terms of its approach to international scientific outreach during the 1960s, away from existing structures and organisations like the World Federation of Scientific Workers and toward the creation of a new scientific order in which China would be a scientific superpower within the developing world. Accordingly, the event was open only to scientists from countries in Asia, Africa, Oceania, and Latin America, pointedly excluding those from other parts of the world. Yet for all that the Peking Science Symposium was a vehicle for Chinese ambitions toward increased influence in international

science, the event was also ostensibly organised in close collaboration along with communist parties from North Korea, Vietnam, Indonesia, and Japan. Attendance at the event itself reflected the centrality of these regional collaborators, with over 60% of the delegates came from these countries, while the influence of Japanese scientists and science, in particular, looming large in the proceedings. This paper examines the nature and significance of the involvement of regional collaborators – both scientific and political – in the Peking Science Symposium. In doing so, it elucidates both crucial vectors of influence from within Asia on Chinese science as well as the significance of regional collaboration in China's drive to establish itself as a centre within the scientific world during one of the hottest periods of the Cold War.

Thematic Approaches to the Study of Science | East Asia | 20th century, late | Asian socialism, the politics of international cooperation, regional cooperation, the 1964 Peking Science Symposium, global Cold War

Scientific Facts and Alternative Facts: The Detzner Affair and Fieldwork after Empire

Daniel Midena

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In 1928, the Berlin Geographical Society launched an investigation into whether Hermann Detzner (1882–1970), a former colonial surveyor, had misrepresented his New Guinean expedition in his book, *Vier Jahre unter Kannibalen* (1920). The investigation stretched on for four years and drew in a who's who of New Guinean research and politics at the time from Germany, Australia, and the United States. The investigators' task was made all the more difficult because Detzner wrote his expedition reports from memory after Australian soldiers had destroyed his fieldnotes during World War I. In 1932, Hermann Detzner eventually admitted that his book was 'a factual scientific report only in part' and contained an 'alternative depiction of [...] facts'—in large part to protect the identity of those who shielded him from Australian troops. Consequently, historians today typically dismiss Detzner as an amusing anecdote—yet another August Engelhardt, consumed with

coconuts and sun. Drawing on the investigation notes and other original archival sources, this paper seeks instead to recuperate the Detzner affair as a serious object of study for historians of science for two reasons. Firstly, the loss of Detzner's notes brings into even sharper focus—for us, as for the investigators at the time—the status of notebooks as witnessing devices within the field sciences. And secondly, Detzner's calculated efforts to disseminate genuine 'facts' within a fictional telling of his expeditionary activities raises interesting questions about the role of context in justifying the validity of scientific data.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, early | notebooks, fieldwork, scientific fraud, German colonialism in the South Pacific, Berlin field sciences, geography, surveying

Scorpion Suicide: Experiments and Anecdotes in Colonial England (and beyond)

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I examine conflicting accounts of "scorpion suicide" to explore the entanglement of colonialism, anecdotes, and nascent scientific journals in the late 1800s. The tale of the scorpion surrounded by fire

choosing to turn its sting on itself is one of the most striking images of animal self-destruction. While the experimental tradition on scorpion suicide is almost 300 years old, dating back to work by the French natural philosopher Maupertuis in 1731, the British were relative latecomers. They had a distinct dearth of scorpions until encountering them in colonial holdings like South Africa and India. I show how venues for the international circulation of animal anecdotes and at-home experiments like *Nature* magazine, mixed with British colonial access to scorpions, mixed with concerns about the evolutionary implications of a self-destructive instinct, led to vigorous debate over the reality of scorpion suicide in the 1870s and 1880s. Ultimately, I argue, it was not just the grisly experimental evidence, but also shifting epistemic standards in scientific journals and a denial of the implicit epistemic authority granted to the reports of explorers and colonialists in exotic places that led to the British scientific community turning against scorpion suicide. However, despite this century-old scientific conclusion, the present day persistence of the tale of scorpion suicide, on Youtube and Reddit, on

yahoo answers and pet shop owners forums, and even in non-biology academic papers, reminds of us the complex nature of not just the development, but also the distribution, of scientific findings.

Biology | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general | entomology, British, colonialism

Secrecy and the Early Dutch-Norwegian Nuclear Collaboration

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In spite of the constraints of the Anglo-American nuclear monopoly in the early Cold War, Norway and the Netherlands managed to build and operate a joint nuclear reactor by July 1951. They were the first countries to do so after the Great Powers. Their success was largely due to the combination of the strategic materials of heavy water (Norway) and uranium (the Netherlands). Nonetheless, they had to overcome significant political and technical obstacles. These existed partly because of strict secrecy policies. Diplomats and scientists in the Netherlands, Norway, Britain, France and the United States interacted to provide or sometimes prevent technical and political support. We highlight the interplay

of three elements: strategic nuclear materials, the scientists' particular transnational networks and state power politics. The transnational network of scientists and diplomats was instrumental for the Dutch-Norwegian collaboration to obtain the required support from third countries. In the end, Norway obtained important reactor design information plus reactor graphite from France. The Dutch quietly exchanged their unpurified uranium ore for ready to use British uranium fuel rods. All this eventually received the reluctant blessing of the United States. In the process, various nuclear secrets were tacitly or explicitly shared. By tracing the development of these secrets, we will show how they were co-owned by scientists and the government. This illuminates the broader co-construction of science and diplomacy.

Aspects of Scientific Practice/Organization |
Europe | 20th century, late

Semantics of Biofacts: Introducing Atomic Agriculture in Africa

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The proposed paper will narrate the story of projects to establish nuclear

techniques in agriculture, focusing in particular on Africa. It aims at exploring how arrangements of nuclear and agricultural things gave birth to a third class of objects, i.e. biofacts (irradiated organisms). The questions at stake here are firstly, whether and how irradiated organisms as biofacts acquired meaning on the basis of the competing grammars of both nuclear and agricultural systems, and secondly, to what extent biofacts (of the nuclear age) have impacted the semantics of its constituent realms (nuclear technology and agriculture). Arrangements of nuclear and agricultural things, each emerging from distinct technical and spatial contexts and each based on differing rules/principles of composition, require processes of translation and mutual adaptation, resulting in transformations such as irradiated organisms. The paper will explore how these transformations gave rise to new grammars as techniques of composition, enabling the biofacts of the nuclear age to work. This will help us to understand the success or failure of nuclear projects in agriculture because these projects will only work when they build on a new grammar that imbues agricultural biofacts with meaning

and significance. The paper will first introduce the historical context and one main actor for the development of nuclear techniques in agriculture. Then, two applications – radiation breeding and the sterile insect technology – will be highlighted. Special attention will be paid to attempts to install these applications in Africa, based on sources from the IAEA, especially with respect to Ghana and Nigeria.

Technology | Africa | 20th century, late | Atomic agriculture, Mutation breeding, Sterile insect technology, Biofacts, IAEA

Shallow Water at China's Coast: Depicting Dangers on Early Modern Chinese Maps

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Sailing in unknown territory is a dangerous matter. To make sailing safer, sailors all over the world created maps and rutters, sharing their experience and knowledge. Early modern Chinese seafarers are no exception and we know of several Chinese maps that include warnings of dangerous places along the coast of China and beyond. The maps mark sandbanks, rocky waters, and sometimes include information on previously sunk ships. To depict these dangers, the cartographers used a range of methods: Little dots,

for example, are a typical symbol for sandbanks. Often, the cartographers were not seafarers themselves but had to rely on other sources for compiling the maps. Some cartographers talked to seafarers, others only relied on previous maps and written sources. This leaves the question how useful the maps were. Were they accurate enough (i.e. mapping all the dangers) for seafarers to actually use them or did they only serve to satisfy the curiosity of the learned elite?

Comparing the Chinese coastal maps with other sources – contemporary European maps, as well as modern surveys of the coast – allows to establish the usefulness of the maps. Which dangers did the cartographers choose to depict, which did they leave out? By studying selected coastal maps from the 17th and 18th century, this paper aims to examine the relationship between seafarer, cartographer, and the dangers at sea in China.

Earth and Environmental Sciences | East Asia | 17th century | maps, cartography, shallows, danger,

Shattered Tubes and Spilled Mercury: Meteorological Instruments and Their Challenges, ca. 1790-1850

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Historians of the atmospheric sciences are often quick to specify the threshold of meteorology's modernity as the invention of meteorological instruments (most famously the barometer and thermometer) in the early 17th century. Such a narrative conceals, however, the failure of instrumental weather observations through the following two centuries at least to produce quantifiable natural laws of the weather. And although a more diversified history, of the barometer as "weather glass" and salon furniture has emerged (e.g. Golinski, 2007), the manifold problems which instruments created for the numerous "lay" weather observers remains in the dark. Based on the presentation of archival material from German archival sources of the late 18th and early 19th centuries, this talk aims to survey more generally things that could go wrong when acquiring, transporting, using, repairing, and reading an instrument. Recording precise and reliable data was a challenge in meteorology at

the time because it was, for the most part, not a laboratory science. Rather, the whole point of the observations was to expose the instruments to the elements in stationary (often household) settings or during travel, leaving these fragile objects particularly vulnerable. In addition, I will present the strategies developed over the course of the 19th century to meet such problems. Standardized meteorological data thus emerges as something which had to be actively created, despite continuous "states of disrepair" (Schaffer, 2011), through a cumbersome and labour-intensive dialogue between humans and instruments.

Aspects of Scientific Practice/Organization | Europe | 19th century | Meteorological instruments, Germany, data, observations, instrument failures

Silent Film in the History of Science: Jean Comandon, a Case Study

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Between 1918 and 1924 French doctor and cinematographer Jean Comandon (1877-1970) collaborated with prominent medical practitioners including Édouard Claparède, Jean-Athanase Sicard, and Édouard Long, to produce over fifty films of

patients with neurological and neuropsychiatric conditions. Now archived, these films often show graphic images of twitching limbs, motor disorders, and bodies deemed pathological. Most likely they were produced for medical practitioners and students, but how their intended audience was meant to interpret or understand them isn't immediately obvious. Indeed, all of the films are silent: no sound or text accompanies them. This paper explores the challenges and opportunities provided by silent films as historical sources in the history of science. It aims to contextualize Comandon's films—many of which were produced by the French production company Pathé—within a wider image economy during the silent motion picture era. Though Comandon's microcinematographic films of bacteria have been studied in the secondary literature, his neurological and neuropsychiatric films have been largely overlooked. What emerges from an analysis of Comandon's neuropsychiatric films and their place in the history of medical imaging is his contribution to a larger landscape of measurement and film research on

the pathological mind and body in the aftermath of World War I. .

Medicine and Health | Europe | 20th century, early | Silent film, neuropsychiatry, medical pedagogy, Jean Comandon

Skulls and Statistics: Karl Pearson and Competing Methods of Classifying Races in the Early 20th Century

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Historians often assume that physical anthropology before 1945 relied on a simple typological, descriptive method to analyze skulls and classify races, which was only successfully challenged by populational genetics after World War II. This paper revisits and complicates this history by turning our attention to a fundamental attack on the typological tradition before 1945: by Karl Pearson, his introduction and development of statistical methods in anthropology, and the racial research his Biometric Laboratory produced between 1900-1938. The application of complex statistical formulae to the study of skulls and race unsettled long standing anthropological methods and theories. Whereas anthropologists had long studied the skull by itself, identifying racially-representative "types," biometricians

turned crania into means, standard deviations, and probable errors fit for statistical analysis. “Pearsonian anthropology” greatly expanded a geometric approach to craniometry which was already present in older anthropological practices. This paper argues that Pearson’s approach to craniometry set the stage for a durable relationship between biometry, geometry, and the skull that continues to live on in present-day biometric practices and technologies. At the same time, the paper discusses how anthropologists questioned Pearson’s approach and only partially adopted statistical methods, suggesting that the relationship between skulls and statistics was not sturdy but shaky and not fully trusted. The history of Pearson’s interventions in physical anthropology thus reveals deep divisions concerning the methods of classifying races well before 1945.

Biology | Europe | 20th century, early | Biometry, Craniometry, Statistics, Physical Anthropology, Race, Standardization

Slave Trading and the Ideation of Quantifiable Bodies in the Seventeenth Century

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This paper studies the development of novel ideas about the human body

that appeared in Atlantic slave-trading circuits during the sixteenth and seventeenth century. Using governmental, corporate, and private records from archives in Spain, Portugal, France, England, the Netherlands, The United States, Brazil, Colombia and Cuba, the paper explores the emergence in Atlantic slave-trading societies of a new epistemology that conceived of fungible and universal bodies whose parts were measurable and comparable, as the diseases that affected them, in quantifiable and reproducible ways on the basis of normalized, constant, standards. I argue that these ideas about bodies, which scholars traditionally identify as related to the rise of the New Science and political and medical arithmetics in late seventeenth and eighteenth-century English, French and northern European learned circles, first emerged in sixteenth and seventeenth-century South Atlantic slave-trading societies. These transformations came about as a consequence of slave trading communities’ need for the quantification of the risks involved in trading and investing in human corporeality and its afflictions in a vast Atlantic network of increasingly complex, commercial, technical,

political and legal dimensions. As a result, human bodies' characteristics (height, gender, age, weight, among others), and diseases became quantifiable and normalized as groupable and predictable within a new language of commerce, and appraisal of the flesh. The history of the African slave body, thus, travels (and precedes by several decades) the same paths followed by the history of the quantifiable and universal bodies of public health, epidemiology, and biomedicine.

Medicine and Health | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general

Sobriety, Longevity, and Readers' Responses to Alvisio Cornaro's *Discorsi della vita sobria*

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Harvard University

The sixteenth and seventeenth centuries, a period commonly described as the Scientific Revolution, have been characterized by religious war, seasonal outbreaks of epidemic disease, and an ambitious and expanding sense of what was possible politically, religiously, and scientifically. Lived and imagined longevity pushed the boundaries of what it meant to be human in this dynamic era. This paper takes as its protagonist Alvisio

Cornaro (1484-1566), a long-lived Paduan nobleman who wrote a series of short treatises in the vernacular extolling the "sober life" as the source of his own longevity. Cornaro revised, expanded, and republished this treatise five times between 1558 and his death in 1566. The treatise sold widely in early modern Italy and is a continued bestseller today. I have examined most surviving sixteenth-century copies of Cornaro's treatise. Using a bibliographical and book historical approach, I trace readers' marks and provenance to recover contemporary responses to the possibilities Cornaro peddled. I then situate Cornaro's treatise and its readers within the context of popular works in dietetics and secrets. Cornaro sold the virtues and possibilities of longevity to a non-elite readership who were accustomed to turning to cheap printed sources that integrated alchemical, occult, and medical ideas for popular audiences.

Medicine and Health | Europe | Renaissance

Soviet and Russian Studies of Long-Term Climate Change in Antarctica: The International Context

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The 1959 Antarctic Treaty declared Antarctica a zone of peace and a ‘continent for science’. A number of scholars, however, have pointed to the geopolitical factors which inevitably underlie international scientific collaboration. Whilst accepting this view, the aim of this paper is to suggest that to paint too dichotomous a picture of science during and after the Cold War is to oversimplify a complex situation, especially in regard to Antarctica. Having outlined factors both hindering and favouring scientific co-operation in Antarctica, and the role of the Scientific Committee on Antarctic Research (SCAR) in fostering Antarctic Science, the paper moves on to consider the origins of Vostok station as a Soviet scientific base during the IGY (1957-8). It then discusses the development of deep ice drilling at Vostok, an exercise undertaken for both glaciological and paleoclimatic reasons, eventually involving close collaboration with France and the USA. By the late 1990s the ice core

at Vostok had reached a depth of 3623 metres revealing patterns of climate change over a period in excess of 400,000 years – the world’s deepest ice core at the time. The discovery of subglacial Lake Vostok, whose existence was first detected in the 1970s, is then discussed as involving international collaboration and oversight by SCAR. Finally, attention is paid to the overall contribution of Vostok to our understanding of climate change and to the view that Vostok serves as an ‘iconic record’ for global climate science.

Earth and Environmental Sciences | Global or Multilocational | 20th century, late | Soviet Union, Antarctica, Climate Change

Specimens of Trade: Medical Treatments and Knowledge from Herbal Texts over Time and Space

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Recent research in the area of drug discovery highlights both the value and challenges of utilising historical botanical sources to identify plant species with pharmaceutical potential. Focusing on herbals, this paper reflects on the use of digitisation in research that seeks to trace the exchange of food and medical plant species across cultures

and time. The plant knowledge exchanged will be considered within both the sociocultural contexts of the indigenous medical systems and political climates in which they were documented and the context of this knowledge transfer over time. To demonstrate this, an ethnobotanical database was created from archival sources. The traditional uses, preparations, and scientific evidence for selected species of this ongoing project will be presented as reflections of the individuals responsible for their documentation and case studies of the circulation and exchange of medical knowledge.

Tools for Historians of Science | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general | traditional medicine, ethnomedicine, ethnobotany, ethnopharmacology, history of pharmacy, natural history, spices and medicine, museum collections, herbarium, trade and empire

Spontaneous Innocence: Physiological Knowledge in Medical Jurisprudence in British India, ca. 1856-1918

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The capacity of a human body to spontaneously harm itself was a major concern for medical jurisprudence in the British Raj.

Those accused of crimes against the body could and did claim that the harm they were accused of was caused spontaneously by the victim's body rather than through their criminal actions. These spontaneous capacities were varied and various, ranging from the possibility of 'spontaneous combustion' whereby a human being could allegedly self-ignite, to the notoriously common claim of spontaneous splenic rupture often used by Europeans charged with beating their Indian servants to death. Such spontaneous capacities were also frequently specified by race and gender. The marking or unmarking of spontaneous harm along axes of race and gender draws attention to the ways in which claims of innocence remain a form of situated knowledge thickly enmeshed in contextual articulations of plausibility and power. There has been significant scholarly interest in some of these capacities, such as the tendency to splenic rupture, but they have been looked at in isolation and without much attention to medical jurisprudence. In this paper, I want to pursue three inter-related questions. First, what were the types of spontaneous capacities attributed to the body that could absolve an

accused of any guilt? Second, can these various types of spontaneous activity allow us to detect a coherent physiology of spontaneity in the textbooks on medical jurisprudence? Finally, I will explore precisely how much of this notion of spontaneity was specific to British India.

Medicine and Health | South Asia | 19th century
| Forensics, Medical Jurisprudence, Colonial
Science, Physiology, Chemistry,

Staging the Natural Sciences: An Influential Cross-Platform Natural History Storytelling Strategy (Spain, 1960s-1970s)

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ESQ0818002H

This paper will explore the huge and highly influential natural history media output, including television, radio, encyclopedias and comics, as well as contributions to the mainstream press and scientific journals, by Felix Rodríguez de la Fuente (1928-1980), a pioneering and highly influential naturalist, activist and natural history author and broadcaster in turbulent 1960s and 1970s Spain. Specifically, it will focus on how he blended the portrayal of local wildlife with the depiction of scientific and media practices, and how he played these

elements together, in a very successful feedback loop across different platforms and formats, to actively engage audiences in naturalist-like (scientific, activist) practices in their everyday-life endeavors. This study, situated in the last years of Franco's regime in Spain, such a noticeably changing context regarding politics, the natural sciences, the public perception of animals at large, and media, will allow us to discuss historically the relationship between natural history media and educational content, and will thus contribute to the understanding of key features of contemporary, media-driven science communication.

Tools for Historians of Science | Europe | 20th
century, late | Natural history, Media, Natural
Sciences, Activism, Education

Standing with Science: Ideology and Advocacy for Developmental Disabilities after 1980

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The prominence of disability advocacy grew significantly after 1980. While research, assessment, and therapies for mental retardation and related developmental disabilities were traditionally in the

realm of specialist psychologists, burgeoning advocacy organizations began challenging the classifications and interventions of these experts. This included calls by advocacy organizations like the American Association for Mental Retardation (AAMR) for research on aversive forms of behavior modification—involving electric shocks and other punishments—to be banned. In 1992, AAMR also significantly revised its longstanding and highly influential Manual on Mental Retardation, shifting its focus for classification away from individual impairments and toward societal supports. Some psychologists who specialized in developmental disabilities pushed back, calling these policies and revisions “postmodern,” “politically correct,” and anti-science. They defended scientific research and evidence-based care, framing their approaches as advocating for people with disabilities’ right to scientific knowledge and effective treatments. Advocates countered by arguing that reframing disability as a social issue was not an attack on science. The identity of developmental disability specialists as either primarily scientific or social problems-oriented was central to these

debates. Sociologist Sydney Halpern has argued that clinical specialties associated with scientific innovation have greater prestige than those who address social problems. Building on the work of Halpern, as well as historians of psychology Jill Morawski and Deborah Coon, I argue that these specialist psychologists, who defended their approaches as scientific, sought to maintain their central role in developmental disabilities research and support, while enhancing the status of a historically low prestige field.

Medicine and Health | North America | 20th century, late | developmental disabilities, psychology, advocacy, scientific ideology, classification

Stargas Models of the Universe and the Rise of Statistical Astronomy

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At the turn of the 20th century, William Thomson (Lord Kelvin), inspired by kinetic gas theory, calculated the dimensions of the universe based on stellar velocities in the vicinity of the Solar System, giving rise to "stargas" models of star clusters -- and of the universe -- pursued from 1904 to the early 1920s by J. C. Kapteyn, Henri

Poincaré, Arthur Eddington, Karl Schwarzschild, James Jeans, C. V. L. Charlier and Albert Einstein. The attraction of stargas models, and subsequent formation of statistical astronomy as a subfield of astrophysics, is clarified by the correspondence of Kapteyn and Schwarzschild, in particular. Stargas models of the universe, including Kapteyn's island universe, did not stand up well against observations afforded by the big new North-American telescopes, as E. R. Paul pointed out in 1981. However, the demise of stargas cosmological models in the 1920s did not spell the end of stargas models of star and galaxy clusters. On the contrary, the theorems and methods introduced in this context served as the foundation for stellar dynamics in later decades.

Physical Sciences | Europe | 20th century, early
| statistical astronomy, cosmology

Starving Flies, Exterminating Animals: The Game-Nagana Link, the Great Game Drive, and the Dynamism of 'Zulu Knowledge', ca. 1890s-1920s

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In the 1890s, the British sought to open the Colony of Zululand to European settlement. The country, characterised by abundant green

pastures, was a paradise for cattle, but had been plagued by a livestock disease that the Zulu called uNakane (Anglicised as nagana). Its cause, Zulu farmers insisted, was the presence of legally-protected big-game. David Bruce, a Scottish surgeon-major was commissioned to investigate the disease. His revelations would stimulate a thirty-year controversy into the “game-nagana link” – whether big-game were the source of the disease, and whether exterminating them would eradicate nagana. In 1920, this culminated in a field-experiment dubbed “The Great Game Drive”, in which two-thousand settlers and six-hundred Zulu attempted to exterminate all wildlife south of the Umfolozi Game Reserve. This ‘experiment’ and its reception shaped nagana science in Zululand and entangled the fate of the fauna in a web of class and race conflicts. The game-nagana controversy complicates ideas about the relationship between African knowledge and the sciences as being one of appropriation and erasure. ‘Zulu knowledge’ was a dynamic construct: some settler scientists mobilised it as a form of ancient wisdom, while others took it as a touchstone of ‘primitivity’ and used

it to challenge their opponents. In the wake of the Great Game Drive, it lost its intellectual currency as the purview of science narrowed. The Umfolozi Game Reserve was transformed into a field laboratory in which big-game extermination became yoked to ‘African primitivity’, while bionomics and bacteriology became the ‘official’ means of nagana control.

Earth and Environmental Sciences | Africa |
20th century, early

Statistics and Public Health at the League of Nations

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The League of Nations Health Organization was created as policymakers grappled with the cataclysmic consequences of two pandemics: global influenza and typhus in Eastern Europe. Contemporaries drew one understudied lesson from those pandemics: the value of information, particularly statistics, to prevent the spread of infectious disease. The Polish head of the League of Nations Health Organization from 1921 to 1939, Ludwik Rajchman, believed fervently that statistics would “demonstrate the practicability and

the indispensability of international health work,” perhaps by eliminating epidemics altogether. This paper traces how the Health Organization standardized the content and forms of epidemiological intelligence during the interwar period, how this solidified particular European understandings of disease, and why the Health Organization became the indispensable intermediary between territories whose notation systems had not been mutually comprehensible. Just as patient histories were standardized over the late nineteenth century, League officials sought to mold the numbers that they received. The boxes of submissions from 74 countries, colonies, or territories around the world show myriad methods to represent disease: narrative, drawings, maps, graphs, or tables with signs like circles or pluses that bear little resemblance to statistics today. League officials both solicited more statistics and pushed government officials to generate statistics that fit the League’s vision of how disease should be represented. I show how these initiatives fit into the League’s broader push to standardize financial and economic data. Finally, the

paper explores how the League's system directly laid the groundwork for the international health statistics of the United Nations.

Medicine and Health | Global or Multilocal | 20th century, early | Public health, epidemiology, Ludwik Rajchman, statistics

Staying Home: Modernity, Science, and the Absence of Hospital Birth in the Netherlands, 1918–1940

Hieke Huistra
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Around 1900, almost all European and American births happened at home, but soon after, birth moved into the hospital. Historians such as Judith Leavitt have analyzed the role of obstetrical science in this shift. New scientific insights on how to prevent infections favoured the strictly controlled birth environment only the hospital could offer. Furthermore, pregnant women strongly believed modern science could make birth safe and comfortable – a modern, 'scientific' hospital birth was seen as a good birth; a traditional home birth was not. Thus, in the 1920s and the 1930s, birth started to move into the hospital in most western countries – with one major exception: the Netherlands. Although trust in science was high in the interwar

Netherlands, the number of hospital births remained low, a remarkable contrast still visible today. In this paper, I investigate this difference, which so far, I argue, has not been sufficiently addressed. Most historical work on the Dutch birthing system focuses on the strong position of Dutch midwives, but although midwives are necessary for home births, their presence is in itself not a sufficient explanation for the lack of hospital births. In other European countries with similar numbers of midwives, home births did decline nonetheless. To figure out what made the Netherlands different, I analyze scientific textbooks, practical handbooks, medical case notes, and women's diaries. Together, these sources help me explain why, in the interwar Netherlands, the 'scientific' hospital birth did not acquire the same popularity as elsewhere.

Medicine and Health | Europe | 20th century, early | birth, obstetrical science, hospitals, women

Storied Sex: U.S. Sex Education Films in Sweden, 1925–1933

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Activist Elise Ottesen-Jensen
founded the Swedish Association for

Sexuality Education (RFSU—Riksförbundet för sexuell upplysning) in 1933; by that time she had been corresponding with American birth control activist Margaret Sanger for several years and had established a strong working relationship with Sanger. In this paper I trace the build-up of Ottesen-Jensen's sex education work prior to the founding of RFSU. I examine three borders—geographical, ideological, and educational—to show how conversations on sex instruction that occurred in the United States during the early- to mid-1920s begin arising in Sweden at the turn of the decade and helped secure moral support for RFSU's existence. First films traversed geographical borders, from the United States to Sweden, including the well-received film *Motherhood: Life's Greatest Miracle* (1927, *Moderskap*). Second, films crossed ideological borders. While previously exported American sex instruction films contained messages on birth control and abortions, these newer films examined the consequences of drinking and drugs and filmmakers targeted them to younger audiences. Third, sex instruction films began to enter Swedish school systems, moving

from public theaters, thus intersection the educational border. In 1928, elementary school teacher Sven Karlung deemed sex education “the most delicate subject” but argued it needed to be taught in schools through the use of film; the schoolteacher praised film as a medium for education. I contend that the years leading up to RFSU's founding were formative for the transnational relationship of sex education and its films between the United States and Sweden.

Medicine and Health | Global or Multilocal | 20th century, early | sex education, transnational public health

Stradanus' Nova Reperta: A Tory Interpretation of History

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HPS, University of Cambridge

This article examines the reception history of Jan van der Straet (Stradanus)' *Nova reperta*, the iconic visual account of the modern inventions of the scientific revolution. It reconstructs how contemporary publics responded to Stradanus' prints within Europe and across the globe. As I argue, the *Nova reperta* had a rather limited reception compared to the rest of Stradanus' oeuvre; modern inventions seem not to have been

popular in the seventeenth and eighteenth centuries. Interest in Stradanus was limited to the circles of the Medici in Florence, who used his prints to invent a tradition of supporting learnings and craftsmanship, and to a few humanists and antiquarians who used the *Nova reperta* within a highly religious framework. The talk focuses on two case studies: the French engraver Melchior Tavernier, who relied on the prints of the *Nova reperta* in a court case against the booksellers' guild in the Paris of the 1620s, and the Oxford antiquarian Thomas Hearne, who used the *Nova reperta* to learn more about the early history of printing in order to criticize the 18th-century book trade in the wake of the Copyright Act of 1710. As these two cases reveal, the *Nova reperta*'s images were used for highly political purposes in this period, and were not taken to be as unproblematic accounts of artisanal or scientific work.

Theoretical Approaches to the Study of Science
| Global or Multilocational | Longue Durée

Stress, Strain, and the Nineteenth-Century Medical Marketplace

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This paper considers the overstrained nervous system as a critical component of the framework within which late nineteenth-century medical, literary, and popular culture defined itself as modern. Amidst the overwhelmingly fast pace of modern life, the nervous body emerged in this period as an elastic site of stress and overload, which teetered constantly on the verge of collapse. This created a lucrative market for a range of tonics that would supposedly relieve the sufferings of the modern populace. Bolstered by prevailing medical orthodoxies, a host of individuals and companies eagerly capitalised on this cult of nervous valetudinarianism, and popular tonics, often containing powerful narcotics and stimulants, were patented, marketed, and experimented with as a means of countering nervous exhaustion. The proliferation of such medications prompted, this paper argues, an array of scientific and cultural fantasies of nervous evolution and adaptation in which the body might be continually fashioned and re-

fashioned in order to produce a high-functioning social subject in a fast-paced modern society.

Medicine and Health | Europe | 19th century |
Medical Advertising, Nervous Disorders,
Science Fiction

Stripped Down to Bare Bones: Navigating the Pelvis in Enlightenment France

Margaret Carlyle

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Chicago

Eighteenth-century birthing manuals presented the maternal body as an obstructive factor in natural childbirth. This impulse is best exemplified in visual culture, wherein infant delivery is often reduced to bare bones: the oft ill-fated interactions between maternal pelvis and fetal skull. The tendency to pictorially disembody the mother reflected on a new approach to childbirth that pathologized the pelvic passageway in ways that paved the way for surgical intervention. In this disciplinary reconceptualization, the pelvic parts were assigned the role of a faulty mechanism in the ‘woman machine’ that must be fixed through tools like forceps, which promised to safeguard delivery in cases of infant malpresentation. This paper argues that the rationalization of the pelvic

passageway built on a navigational vocabulary that revealed surgical interest in colonizing the female body by way of the explorer. Obstetrical ‘atlases,’ not unlike contemporary cartographic ones, mapped the female body using such navigational terms as pelvic inlet, delta, and birth canal. This terminology provided a new paradigm for exploring the female body as a kind of ‘terra incognita’ that was matched by visuals of the pelvis, often in grid form, which charted her anatomy in terms of oceans and landmasses. Both forms of mapping relied on the development of new tools—for obstetricians, the pelvimeter quantified the pelvis, while for navigators, the marine chronometer measured longitude at sea. In both cases, the aim was to create a universal lexicon and iconography by which obstetricians, as cartographers, could map bodies in communicable ways.

Medicine and Health | Europe | 18th century |
instruments, obstetrics, body, colonialism,
France

Substitute Materials during the Twentieth Century

Matthew Paskins
LSE

Attempts to discover whether or not one material can be used in place of another run through the history of science from antiquity to the present. This paper gives an overview of twentieth century histories of substitute materials as a technoscientific-political project. Successful substitution typically involves a coordination between material availability, narratives of use, experimental practices to discover similarities and differences between material affordances, and regimes of testing and regulation. Substitute materials are also invested with potent narratives which connects them with political aims. During the twentieth century historians have associated substitute materials primarily with a range of political projects, notably the chemurgical movement in the USA during the 1930s, British colonial development schemes in the post-world war two period, and the ersatz economies of the Soviet Union and Nazi Germany. It is thus framed as arising in exceptional condition, arising with conditions of war and emergency. Substitution can also be

understood as a more gradual and quotidian series of material transitions and coexistences. Examining these more chronic attempts to substitute gives a way to relate histories of chemistry to geographies of production, and their associated ideologies.

Chemistry | Global or Multilocal | 20th century, early | autarky, chemurgy, substitution

Successful at Second Attempt: Cross-Disciplinary Collaboration on Flower Pigmentation and the Emergence of Chemical Genetics

Caterina Schürch
LMU Munich, History of Science

In the course of their study of the heredity of flower color, William Bateson, Edith Rebecca Saunders and Reginald Punnett observed that in Sweet Peas and Stocks, the crossing of two white-flowered strains produced purple flowers. Bateson's student Muriel Wheldale quickly recognized the potential of this observation for advancing "a chemical basis for Mendelian phenomena". She assumed that by combining the Mendelian methods for determining the laws of pigment inheritance with chemical methods for the isolation and analysis of these pigments, it should be possible to elucidate the mode of action of

Mendelian factors, and at the same time solve the problem as to what chemical processes underlie the production of anthocyanin pigments. In her view, chemists interested in explaining anthocyanin biosynthesis, and geneticists whose goal was to understand the operation of genes were in fact interested in one and the same mechanism. However, Wheldale didn't make the breakthrough she had hoped for. It was her student Rose Scott-Moncrieff who, in collaboration with chemists Robert and Gertrude Robinson and geneticist William Lawrence, was able to establish in the 1930s that gene action is essentially a control of chemical processes. This second attempt was so successful, I will argue, because Scott-Moncrieff managed to convince the chemists and geneticists that joining forces with researchers from other disciplines would help them to solve their own research problems in an adequate way. Furthermore, I will use the case of anthocyanin research to highlight the significance of interfield objects and interfield practices in cross-disciplinary collaborations.

Biology | Global or Multilocational | 20th century, early | genetics, botany, biochemistry, interfield practices,

Surgeons and the Medicalization of Urban Italy: Print and Manuscript Evidence

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C.N.R.S. / Institut d'Histoire Moderne et Contemporaine, Paris, France

Surgeons were key agents in the medicalization of early modern Italy, where a sophisticated medical economy combined medicinal consumerism with a widespread culture of hygiene. From the modest bloodletter up to the university-trained surgeon, they provided all kinds of health and beauty treatment for the urban society, including its lower strata. Excellent studies have delved into the Italian tradition of Renaissance learned surgery. In contrast, with few exceptions (notably S. Cavallo), the culture, work and intellectual output of the common practitioners remain largely unexplored. Although they are unanimously viewed as go-betweens, relatively little attention has been devoted to the role played by surgeons in sustaining medicalization across different social groups, as well as in promoting change in the physiological and pathological ideas that underpinned it. This paper aims at bridging this historiographical gap. By analysing printed surgical

books in the period 1650-1800 both as texts and objects, it tackles the circulation of surgical knowledge in multiple audiences and the social diversification of health care, while shedding light on surgeons' strategies of self-fashioning according to their background and professional profile. Manuscripts, however, reveal other aspects and trajectories of this process. Indeed, in this same period, manuscript surgical texts – transcripts of lectures, compendia, surgery casebooks- continued to be produced and circulated. I will argue that they offer new insight into the evolution of surgical culture, as well as into the ways it was transmitted and appropriated by different milieus.

Medicine and Health | Europe | 18th century | Surgery, lithotomy, innovation in science and medicine, medical marketplace, apprenticeship.

Surgical Instrumentation in the Practice of Craniotomy in 19th-Century Brazil

Isabela Dornelas

Federal University of Minas Gerais

This paper focuses on the use of craniotomy in the exhausting and long labor of the imperial heiress of Brazil, Isabel de Bragança, in 1875. It analyzes the arguments around the use of this technique using as its main source the medical report of

that event (1876). Obstetricians performed the craniotomy technique with the Smellie scissors, created by English obstetrician William Smellie in the 18th-century, for use in cases of either a restricted pelvis or an excessively voluminous fetal skull. These scissors decreased the volume of the fetal skull by removing the cerebral mass. The decision to conduct the craniotomy on such a high-ranking woman caused controversy in the Brazilian medical world. Most medical literature understood craniotomy as a procedure more dangerous than forceps because it caused fetal death. Disagreement over the use of craniotomy showed that, while this technique ensured maternal survival, it also led to the inevitable mutilation of the fetus and damage of the maternal perineum. For these reasons, the procedure was considered to be inherently violent. This paper argues that a tension remains between having knowledge of a technical resource and the use of it. Technical resources, even when deemed violent by medical opinion, were nonetheless used when necessary.

Medicine and Health | Latin America | 19th century | instruments, obstetrics, craniotomy, body, gender, politics, Brazil

Symbol and Knowledge: 'Absolute Infinity' in Georg Cantor and Pavel Florensky

Tatiana Levina

Higher School of Economics (National
Research University)

The research theme is the reception of Georg Cantor's ideas in Russia. Russian philosopher Pavel Florensky have been influenced by Georg Cantor's ideas and wrote a paper "On the symbols of infinity" in 1904. In this paper he says that transfinite mathematics of Georg Cantor is an example of symbolic vision of God. Cantor's idea from the "Grundlagen einer allgemeinen Mannigfaltigkeitslehre" is that "absolute can only be acknowledged but never known". The absolutely infinite sequence of numbers thus seems to him to be an appropriate symbol of the absolute. Symbol, as Pavel Florensky wrote in his memoirs, was the most important concept in his philosophy throughout his life. Symbol has distinctive ontological modus of existence and its property is to be the reference for the higher being, namely God. It could also be associated with the concept of *minimax* by Nicolaus of Cusa. I analyze the meaning of symbol in Cantor and Florensky and juxtapose

them with the understanding of the symbol by later Florensky and other interpreters. I also examine the view of theologian Christian Tapp, who researched Cantor's interest in theology. He understands symbol as a minimal in the theory of Cantor. Johanna Van der Ween and Leon Horsten represent Cantor's conception in the context of European philosophers, whom Cantor read. The main problem of the paper is how symbol and absolute infinity could be connected and whether the meaning of symbol implies understanding of the higher being or it is not necessarily incorporated into the concept.

Theoretical Approaches to the Study of Science
| Europe | 20th century, early | Absolute Infinity,
Pavel Florensky, Georg Cantor, Metaphysical
Realism, Symbol, Transfinity, Platonism

Teaching Entomology through Images: Insect Representation in Wallcharts between the Nineteenth and Twentieth Century

Elena Canadelli
University of Padova

The presentation focuses on how insects have been represented and taught in schools and universities between the nineteenth and twentieth centuries, often in relation to matters like public health,

economic botany or agriculture. As argued by Massimiano Bucchi (1998), the “golden age” for such a genre of didactic communication is to be located between 1870 and 1920. In this period several different kinds of wallcharts were produced, printed, and sold in large quantities thanks to the improvement in lithography: from the collection published by the German Rudolf Leuckart and Hinrich Nitsche (1877-1892) to the collection edited by the French Rémy Perrier & Cépède (1880-1930). Insects were present in many of these collections with peculiar visual languages and styles of representation. In many universities handmade wallcharts were also prepared by students and professors. It was the case of the anonymous collection realized by the zoologists of the University of Padova at the beginning of the twentieth century (https://phaidra.cab.unipd.it/detail_object/o:12794), which tells us a lot about the importance of visual representation in zoological education and knowledge-making of the time. It reveals how subjects were chosen and how to represent insects by looking at the major printed collections, which marked a standard in the field. Looking at

both history of science and history of education, this presentation aims at highlighting the different ways in which insects have been represented and used in science education as popular visual educational tools and tries to understand the circulation of some “favourite” motives.

Biology | Europe | 19th century | Entomology, Education, Images, Universities, Zoology, Collections, Pedagogy

Technical Assistance and Socialist International Health

Dora Vargha
University of Exeter

From the establishment of the World Health Organization in 1948, the question of technical assistance was hotly debated by Eastern European countries. Recuperating from the war and undergoing radical political change, countries of the Socialist Bloc were both recipients and donors of technical assistance in a newly forming system of international health. These countries had specific ideas about the obligations of states and the role of technical aid in health that did not necessarily map on the dominant, US-led interpretation. While there is a growing literature on technical assistance and development between Eastern Europe and the so-called

Third World, the role of technology and expertise at the intersection of liberal and socialist international health has been little explored. Through the case of hospital building projects and expert networks from a Hungarian perspective, this paper asks how we can understand socialist engagement in international health, and how technical aid among the Second and Third worlds fitted into a broader system of technical aid and international health.

Medicine and Health | Global or Multilocational | 20th century, late

Technologies of Innocence and Guilt: The Introduction of New Forensic Technologies in Dutch Courtrooms

Lara Bergers

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No criminal defendant, in principle, has to prove his own innocence. It is enough to sow doubt about the argument that the prosecution is making: *in dubio pro reo* (when in doubt, for the accused). Yet suspects and their defence attorneys frequently attempt to do just that. In their efforts they may enlist forensic technologies that are thereby presented as what one might term ‘technologies of innocence.’ Of

course, these same technologies could also be turned against the defendant and thus become ‘technologies of guilt.’ This paper explores the processes by which new forensic technologies are conceptualized as ‘technologies of guilt’ and ‘technologies of innocence.’ To that end, I look at the introduction of several forensic technologies in the Dutch legal system in the twentieth century, including lie detection (briefly introduced in 1956) and DNA (first used in the Netherlands in 1988). Characterized as an inquisitorial system, which relies on supposedly ‘neutral’ court-appointed experts, the Dutch legal system might be seen as an unlikely site for such an analysis. I contend, however, that, in practice, technologies and expertise are not significantly more neutral in the Dutch inquisitorial system than in adversarial systems.

Technology | Europe | 20th century, late | Lie Detection, DNA, Forensic Science, Science & Law, Dutch History, Objectivity

Telling Histories of the Republic of Letters in the 18th Century: "History of Learning" as Expression of Growing Self-Awareness of an International Community of Scholars and Scientists

Dirk Van Miert

Descartes Centre, Utrecht University

It is a historiographical orthodoxy that the 18th century witnessed the rise of a historical consciousness, partly in response to what Hazard called the crisis of the European mind. Within this rise, we can identify a particular historical sub-genre: that of History of Learning. This 'historia litteraria' marks the beginning of History of Science. It is by now a well known albeit still understudied phenomenon, prevalent in Germany from the late 17th century onwards. I will show how, within this historiographical tradition, which takes its cue from Bacon's *Advancement of Learning*, the emphasis shifted from the remote to the more recent past. The 18th-c. history of recent learning points at a growing self-awareness of the Republic of Letters as a social phenomenon, noticeable also from the rise of the scientific journal, editions of complete works of recent scientist and scholars, the posthumous editions of letters, and

table-talks and the expanding scholarly apparatuses accompanying these editions. The scientific and scholarly community started to assert its own independence from state and church, and retroactively projected their own enlightened ideals back onto the earlier history of the Republic of Letters. This is causing the modern historian considerable problems: we are still reading the 16th- and 17th-c. socio-cultural history of learning through the prism of Newton, Bayle and Voltaire and fail to appreciate the variegated history of the deceptively stable term 'Republic of Letters', which in fact experienced many ups and downs through time and across space.

Thematic Approaches to the Study of Science | Europe | 18th century | republic of letters, history of knowledge, history of historiography, scientific communities

Text Mining and the Conceptual History of the "Republic of Letters"

Karen Hollewand

Utrecht University

All that we know about the early modern Republic of Letters, from the heterogeneity of its membership to its continued significance in the learned world of the sixteenth, seventeenth, and eighteenth

centuries, is based on traditional historical research: the close-reading of historical documents. Yet, as the number of primary sources shared online keeps growing, it is time to discover how computational approaches can advance our understanding of this complex community. In my paper, part of my research for the SKILLNET project, I will explore the use of digital text mining in the study of the conceptual history of the ‘Republic of Letters’, investigating if and how the distant reading of a large corpus of letters can trace key concepts that relate to a sense of commonality and to the ideal of sharing knowledge. Looking at the frequency and spread of words, I am mapping the main ethical notions which held this learned community together. Did these notions change over time or differ according to, for example, region, language, or religion? Can they tell us if this knowledge society represented a utopian idea, detached from religious and political concerns, or if we should explain its long-term significance in relation to its pragmatic value, allowing scholars to share their thoughts and texts with each other? Exploring these questions, my paper will touch upon the construction of my

principal dataset, comprising of more than 80,000 early modern letters, and discuss the complexities of conducting experiments with a historical and multilingual corpus.

Aspects of Scientific Practice/Organization | Europe | 17th century | Republic of Letters, correspondence, text mining, digital humanities

Text-Mining Early Modern Collective Lives of Scholars for Scholarly Virtues

Koen Scholten

PhD candidate, Utrecht University

The *respublica litteraria*, the imagined community of scholars in the early modern period, was kept together beyond confessional borders through collective ideals. These ideals were celebrated and embodied by exemplary scholars – most notably Erasmus – who served as role models for virtue and participation in the learned community. By presenting an overview of the virtues ascribed to exceptional and exemplary learned men we gain insight into the development of the transconfessional *respublica litteraria* in the sixteenth and seventeenth centuries. Early modern collective scholarly life-writing often referred to as “*vitae*” or “*elogia*” offered an overview to early modern readers of the most

eminent scholars, their deeds and virtues. This paper will present the results of a text-mining analysis of a variety of collective scholarly life-writings. Vitae and elogia from both sides of the confessional divide will be taken into consideration and compared against each other. Do Italian or Dutch compendia of scholars include the same scholars? And, more importantly, were scholars ascribed the same virtues throughout Europe? All in all, this paper addresses the scholarly virtues expressed in collective scholarly life-writing in the early modern period.

Aspects of Scientific Practice/Organization | Europe | 17th century | scholarly life-writing memory identity

Textures of Anatomy: Images and Practice at the University of Padua in the Seventeenth Century

Megan Baumhammer
PhD Student, Princeton University

In this paper I explore the relationship between skin, skin represented as fabric, and fabric covering skin within this context of seasonality in the representation of human bodies in anatomical works of the seventeenth century. I begin with engravings by Odoardo Fialetti, commissioned by Giulio Cesare

Casseri, professor of anatomy at the University of Padua for his *Tabula Anatomica* (1627). These are some of the most remarkable examples of representational choice in the history of anatomy. The evidence of dissection is contrasted with plants and trees in the height of summer foliage. These images show people disrobing themselves of their skin, or as though an invisible hand were casting their skin aside like fabric. The conflation of skin with cloth in these images reinforces a paradoxically lively presentation of the cadaver, and blurs the relationship of the human body to the surrounding environment. This depiction is in remarkable contrast to the circumstances of bodily dissection in the early seventeenth century, which occurred by necessity in the winter. The seasonal experience of medical teaching at the time reflected the availability and ease of use for teaching materials. University medical education centered on the teaching of the experiential sciences of botany and anatomy. In this paper I analyse the practice of anatomy at Padua in the context of costume books and the fabric trade in the Republic of Venice. I show that the novelties of the early modern world

and the novelties of anatomy are key in knowledge in Renaissance medicine.

Medicine and Health | Europe | 17th century | Anatomy, representation, history of medicine

The “African Horse Sickness” and the Threat of Movement

Tamar Novick

Max Planck Institute for the History of Science, Berlin

This talk centers on the “African Horse Sickness” that plagued the Middle East for the first time in 1944, resulting in the termination of thousands of animal lives. In that context, equines were cardinal to agricultural work and economy, to connecting rural and urban areas as transporters of goods, but also to the governing rule and its policing powers under the Mandate system. The disease hit the region in a transformative period, moreover, as the role of animals as global migrant-laborers was shifting. Soon after, automated machines relieved their burden, and transformed the relations between farmers, veterinarians, the state, and the global market. Debates about the nature and management of this disease, which never threatened human lives, but influenced them in fundamental ways nevertheless,

ultimately contributed to new ideas about energy, work, and migration, and to studies in epidemiology and agricultural production.

Technology | Near and Middle East | 20th century, early | agriculture, epidemiology, animal labor, movement, Middle East, animal-human relations, energy

The “Skins” of the Earth: Artisan Expertise and the “Discovery” of Geological Strata in Fifteenth-Century Italy

Ivano Dal Prete

History of Science and Medicine, Yale University

The idealized representation of geological strata is one of the most striking aspects of late fifteenth-century Italian pictorial landscapes. Yet medieval learned “meteorology”, which also included today’s geology and mineralogy, largely ignored this highly visible feature of the Earth’s surface. In this paper, I argue that the investigation of Earth strata (or “skins”, as they were called) was indeed an empirical skill, practiced by artisans involved with mining and civilian or hydraulic engineering. The knowledge of different “soils”, of their properties, and of their vertical differentiation was a practical tool, employed by water prospectors to locate water sources or by builders

to design the foundations of edifices. The common understanding that the crust of the Earth was composed of “page-like skins”, made then its way into paintings whose authors belonged to the same cultural and social environment (and were sometimes the same person). Literary masterpieces of the Italian humanism, like Leon Battista Alberti’s *On the Art of Building*, attest that this knowledge did not remain confined to trade expertise and to oral and vernacular communication. Leonardo da Vinci’s discussion of Earth strata has often been touted as an example of unique genius ahead of his time. On the contrary, I suggest that the Tuscan artist built upon a decades-long tradition of artisanal knowledge and practices, which he framed within a theoretical template mostly derived from Aristotelian meteorology.

Earth and Environmental Sciences | Europe | Renaissance

The (Banana) Landscape and Archaeology in Central America, 1890-1940

Sophie Brockmann
De Montfort University, UK

This paper explores how different interpretations of the landscape and

environment around two archaeological sites of 20th-century Central America (Quiriguá in Guatemala and Copán in Honduras) made these sites contested spaces. It follows thematic trends across the records of several North American archaeological expeditions between the 1890s and 1940s, chiefly the Harvard Peabody Museum expedition to Copán in Honduras in 1892-3 and the expedition to Quiriguá in Guatemala, led by William Duncan Strong for the Bureau of American Ethnology in 1936. Field sites were not self-contained scientific spaces, but embedded in a rural landscape with all its social, agricultural and commercial relationships. Local, regional and transnational actors all had a stake in controlling the natural and built environment, and foreign and local scholars, farmers, and labourers interacted in different ways with these environments. In fact, by paying attention to the micro-geographies of the archaeological field site, we can uncover facets of daily life and labour relations in the rural landscapes which were fundamental to Guatemalan and Honduran history in this era. Archaeologists and local farmers argued about agricultural

practices within the supposed boundaries of the archaeological sites. In the case of Quiriguá in particular, which was located in the midst of a United Fruit banana plantation, the terrain's primary function as an agricultural landscape (the archetype of 'tropical agriculture' for North Americans) permeated all aspects of the archaeologists' practice, from finding suitable labourers to fashioning themselves 'tropical explorers'.

Earth and Environmental Sciences | Latin America | 20th century, early | environment, archaeology, field science, bananas, Guatemala, Honduras

The Algal Organism at the Beginning of Biology

Ryan Feigenbaum
History of Science Society

In the eighteenth century, algae were wretched organisms, receiving scant attention from naturalists, who largely preferred animals as their subjects of research. This predilection held true for J. F. Blumenbach, who devoted less than 5% of his influential *Handbuch der Naturgeschichte* to plants and even less to algae. It is surprising, then, that a species of algae, *Conferva fontinalis*, played a crucial role in Blumenbach's own research

program and contributed essentially to the advent of biology. I argue that *C. fontinalis* was so important for this development because it functioned as a proto-model organism, in that Blumenbach selected it precisely for its epistemological and practical advantages. First, he recognized that its physiological simplicity enabled him to overcome foregoing difficulties in embryology, which freed him to formulate a new theoretical foundation of biology that contributed to knowledge of living beings as such. Second, because *C. fontinalis* was easy to procure, maintain, and propagate, Blumenbach knew that any naturalist could replicate his experiments. This self-consciousness in selecting a subject of study predates the reasoning that stands at the beginning of Gregor Mendel's famous work on peas by 84 years, the latter often cited as the first example of a model organism. In the history of biology, then, the model organism is not a phenomenon that occurs after the science has already begun, but one which is concomitant with its beginning. Blumenbach's work on *C. fontinalis* forces us to reassess the

inauguration of biology, in its history and its present.

Theoretical Approaches to the Study of Science
| Europe | 18th century | Blumenbach, Algae,
Model Organism

The Alienisation of Childhood and Adolescence in France and Scotland, 1870-1914

Axelle Champion
University of Edinburgh

During the last quarter of the nineteenth century, the medical gaze turned itself upon the child and the adolescent, promoted them as new objects of science. In both Scotland and France, an alliance between political and medical men was formed to deal with their respective demographic crisis: public health, hygiene, as well as personal behaviours were targeted to improve child health. Both nations developed similar anxieties and fears over their population growth, and addressed these challenges in a similar way - through the introduction of pieces of legislations as well as formulating social and medical precepts promoting child welfare. Yet, some crucial differences in their implementation emphasise distinct approaches to the medicalisation of childhood and adolescence, which would ultimately bear consequence to the 'alienisation' of both periods

of life. This paper addresses the question of child and adolescent development and its interpretation within psychiatric discourses in both France and Scotland in the late nineteenth and early twentieth centuries. It will stress out how paediatrics became a separate field of study in both countries, signing off different perspectives to the question of the young body in health and sickness. This will allow us to understand how the medicalisation of childhood and adolescence, under the influence of evolutionary psychology and pedagogy, concurred to form different discursive traditions on mental abnormality in young people. In other words, this paper will show how the emergence of child and adolescent psychiatry sits at the crossroads of competing, yet complementing, medical, psychological, social and educationist discourses.

Medicine and Health | Europe | 19th century |
psychiatry, paediatrics, development, young
people

The Amateur's Gaze vs. the "Learned" Eye: Theorizing Natural History Collections in the Second Half of the 18th Century

Rossella Baldi
SIK-ISEA Zurich

The flourishing practice of natural history collecting, which characterized the second half of the 18th century, was supported by a major theoretical effort to define how samples should be collected, preserved and displayed. This specialized literature was mainly produced within the French academic world to educate the non-specialized readership and to provide naturalists with the right methods to set up their cabinets. As a consequence, texts theorized two opposite views on collecting, reflecting two different approaches to nature. On the one hand, the scientific collection, aimed at the most faithful reproduction of nature and its laws through a rigorous and methodical display of the specimens; on the other hand, the amateur cabinet, conceived a space for visual pleasure where to contemplate natural beauty and inside which aesthetic choices offset the difficulty of making natural order visible. This paper will question this theoretic dichotomy. I will argue that the

scholarly French élite referred to the "taste vs. method" opposition as a strategy to discredit non-professional collectors in order to legitimize the practice of scientific collecting as the only one able to formulate a valid scientific content. As a matter of fact, was the opposition between amateurs and scientists truly operational? Was it really possible to exhibit nature in a cabinet without using any decorative artificialities which, according to scientists, prevented the visitors of natural history cabinets from experiencing and understanding the natural order?

Aspects of Scientific Practice/Organization | Europe | 18th century | Art, Collecting, Gaze, Amateurs, taste, cabinet, museum, readers, publics

The B.S. Degree: A New Objective in Nineteenth-Century American Catholic Higher Education

Dana Freiburger
University of Wisconsin-Madison

My talk surveys issues coincidental to the introduction of the Bachelor of Science (B.S.) degree at nineteenth-century American Catholic institutions of higher education. Starting with Santa Clara College, a Jesuit school in California that conferred a B.S. degree in 1859

and continuing to 1900 (and beyond) with the College of Notre Dame of Maryland that awarded B.S. degrees to women, a total of nineteen Catholic institutions deemed the Bachelor of Science a fitting academic honor alongside the venerable Bachelor of Arts (B.A) degree. Essential to a B.A. was its objective of inculcating mental discipline in a student, an ideal usually achieved through the study of Latin and Greek over several years. In contrast the B.S. dispensed with these dead languages and in their place granted more emphasis to the various sciences along with the modern languages, practical substitutions made in response to the escalating demand for Catholic colleges to offer a more useful education. Based on my ongoing dissertation research, I argue that this new objective to award Bachelor of Science degrees evolved out of an existing Catholic educational commitment to teach science to students. Moreover, it demonstrated how Catholics found a way to package a science education which remained in touch with their long-held classical educational practices, like those found in the *Ratio Studiorum*, while offering a

curriculum that provided a desired knowledge of science.

Social Sciences | North America | 19th century | science education, academic degrees

The Background of the Umwelt Concept: Jakob von Uexküll's Theoretical Biology

Carlo Brentari

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The concept for which Uexküll is best known is his notion of the environment (Umwelt) as a species-specific subjective construction. This concept, however, takes its full meaning when situated in the context of Uexküll's overall reflection on biology. The constitution of the perceptive and operative Umwelt is seen by Uexküll as part of a wider complex of organized morphogenetic, physiological, anatomical, and behavioural processes. This clearly emerges from the two editions of Uexküll's *Theoretische Biologie* (1920; second, expanded edition 1928). Starting from these considerations, this paper aims to provide an overview of the links between Uexküll's theoretical biology and related scholars and debates. The discussion will center on two chief issues. Firstly, the influence of other authors (Johannes

Müller, Hermann von Helmholtz, Jacques Loeb) on Uexküll will be outlined. This will give us the opportunity to discuss Uexküll's reception of Immanuel Kant's transcendental approach; through the mediation of Helmholtz, in fact, Kant's theory of perception assumes a great relevance for Uexküll's physiology and theoretical biology (not by chance, the first two chapters of *Theoretische Biologie* are titled respectively "space" and "time"). Secondly, the paper addresses Uexküll's position in some long-term biological debates in the 19th and early 20th Centuries: the mechanist-vitalist debate; the discussion about nature and function of cellular protoplasm; the issue of teleology (in Uexküll's terminology, *Zweckmässigkeit*, "purposefulness") in biological phenomena. A final evaluation will be offered on the possibility of updating Uexküll's theoretical biology.

Biology | Europe | 20th century, early |
Theoretical Biology, Jakob von Uexküll,
Immanuel Kant, Umwelt

The Categorisation of Hearing Loss through Telephony in Inter-War Britain

Coreen Mcguire
University of Bristol

The telephone in inter-war Britain was an important tool for both the identification and categorisation of individual hearing loss. Between 1912 and 1981, the British Post Office had control over a nationalised telephone system. Linkage between telephony and hearing has long been noted by historians of sound and science and Post Office engineers in the inter-war period had considerable expertise in both telecommunications and hearing assistive devices. This talk will first demonstrate how the interwar Post Office categorised different kinds of hearing loss through standardising the capacity of its users to engage effectively with the telephone, and secondly investigate how successful it was in doing so. By utilising the substantial but little used material held by BT Archives, we can trace the development of the Post Office's 'telephone for deaf subscribers', and explore how it was used to manage and standardise the variability of hearing and hearing loss within the telephone system. This talk will

highlight that institutional decisions about the types of measurements we prioritise and the types of bodies we choose to measure as standard have been heavily weighted with historical biases and discrimination. Examining the creation of 'normal hearing' in inter-war Britain thus allows for wider consideration of the technological construction of disability.

Technology | Europe | 20th century, early | telephony, disability, hearing-loss, users, standardisation.

The Circulation of Morphological Knowledge: Twentieth-Century Science of Form between Evolutionary Biology and Architecture

Marco Tamborini

Institut für Philosophie, TU Darmstadt

In 1971, biologists Stephen Jay Gould and Richard C. Lewontin criticized the agenda that had “dominated evolutionary thought in England and the United States” according to which natural selection is seen as an “optimizing agent”. Conversely, they proposed a different standpoint on evolution, in which body plans are “constrained by phyletic heritage, pathways of development and general architecture”. As they admitted, while this different focus on

evolutionary mechanisms was “long popular in continental Europe,” it was almost entirely absent in English-language biology. Given this background, how did this “European” perspective come to form the basis for a major theoretical challenge to Adaptationist thinking? What were the sources of this perspective? In my talk, I point out that this rethinking was possible through an exchange and transfer of practices, data, technologies, and knowledge between biologically oriented students of form and architects, and engineers. Specifically, I analyze how morphological knowledge traveled from evolutionary biology into architecture and back during the 1960s. As a case study, I focus on the Stuttgart Collaborative Research Center on wide span surface structures. In this research center, architect Frei Otto and biologist Gerhard Helmcke developed a structural analysis of morphogenesis. According to this analysis, an efficient form is obtained by using as little material as possible in line with the lightweight principle. Hence, by showing how morphological knowledge traveled during the 1960s, my presentation will provide

preliminary insights into a different history of twentieth- and twenty-first-century science of form.

Biology | Europe | 20th century, late

The Collected Letters of Sarah Maria Smythe: Communicating Darwin's Coral Growth Theory to Belfast Readers, Ten Months in the Fiji Islands (1864)

Anne Ricculli
Drew University

In *Ten Months in the Fiji Islands* (1864) Sarah Maria Smythe narrated her military husband's recent evaluation of the strategic and economic feasibility of British plans to annex the Fiji archipelago. Her published letters described her own contributions to concurrent Royal Botanic Gardens, Kew-sponsored explorations of the islands' floral resources. Her drawings of coral reefs, however, document her application of the science of geology, and Charles Darwin's theory of reef growth, to explain configurations of Fijian marine regions. Sarah Maria Smythe's correspondence in *Ten Months in the Fiji Islands* (1864) has been briefly studied under the genre of Victorian women's Pacific-region travel narratives (Claudia Knapman 1997). Keeping with the HSS

conference theme "Telling the Story of Science," I situate Smythe's illustrations of reef architecture, rendered as chromolithographs by the celebrated Vincent Brooks, within the public education on the science of geology during a robust schedule of public lectures in Belfast. I argue that Smythe, member of a prominent household in Protestant Northern Ireland, engaged with theoretical geology during Belfast's self-identification as active participant in networks of British colonial-region resource management. More broadly, the Belfast education series framed Darwin's coral research to general audiences in the context of environmental change, themes subsequently conveyed to the public as *Origin of Species* (1859) circulated in Ireland through lending libraries and in printed reviews. Smythe's volume demonstrates the nineteenth-century public embrace of contemporary geological theory and field research as one element in a Victorian-era scientific toolkit used to evaluate resources in changing imperial environments.

Earth and Environmental Sciences |
Australasia/Oceania | 19th century

The Cosmic Eros of Renaissance Vitalism: A Reassessment

Pietro Deniel Omodeo

ERC EarlyModernCosmology, Ca' Foscari
University of Venice

Vinculum vinculorum amor est. Giordano Bruno's statement, "the chain of chains is love," served Ioan Petru Culianu, in his classic on Renaissance magic, to summarize the conception that eros is the universal principle agitating nature. The living cosmos is sentient in all of its parts; desire keeps together reality at the micro-scale of terrestrial beings, and at the level of celestial motions and their metaphysical aspiration towards their unitarian source. According to vitalistic vistas from Ficino to Bruno and beyond, an adequate knowledge of the driving force of eros is the precondition for the effective channeling of nature towards individual and collective goals. The spirit of the incipient "Scientific Revolution" conferred an operational connotation to these ideas of neo-Platonic origin. The speculative character of classical Platonism was dismissed in favor of practice, while Scholastic constructions were cast into doubt as inapt to account for the new worlds opened up by scientific novatores

alongside cosmographers and cosmologists. The linkage of science and magic constituted the vitalist philosophers' specific path to useful knowledge. Culianu regarded Tommaso Campanella as paradigmatic of this trend, although he did not expand on the conceptions of this "attardé de la Renaissance en pleine Réforme." It is worthwhile considering Campanella's philosophy of cosmic eros, and the continuity he established between scienza and magia, magic and technology (particularly the three Baconian technologies: compass, gunpowder and press) as a manner to reassess, continue and deepen Culianu's inquiry into nature and desire à la Renaissance, 35 years on.

Physical Sciences | Europe | 17th century

The Data of Development: North-South Tensions in the International Hydrological Decade, 1965-1974

Etienne Benson

University of Pennsylvania

The International Hydrological Decade (1965-1974) was a UNESCO-led program of research and training in the water sciences that laid the foundation for the International Hydrological

Programme, which is still active today. Inspired by the International Geophysical Year (1957-1958) and other Cold War-era projects of scientific internationalism, the IHD was initially launched with the aim of modernizing hydrology in a way that would solve urgent global problems. One of its leaders, the U.S. hydrologist Raymond L. Nace, justified the IHD in the following terms: “Studies on continental, hemispheric, and global scales are necessary to cope with the future problems of water supply in a world that seems destined to be overpopulated, defaced, and polluted.” With these anxieties in mind, Nace and the other architects of the IHD sought to standardize international water data collection in ways that would serve both basic science and applied needs and would appeal to hydrologists in both developed and developing nations. At the IHD’s Mid-Decade Conference in 1969, however, it became apparent that developing-nation hydrologists were deeply unsatisfied with the IHD’s implementation of these aims. They were particularly vocal in their criticism of efforts to standardize water data in ways that served developed-world hydrologists but

disregarded the practical water needs of developing countries. This paper examines data collection, storage, and sharing in the IHD as sites for the negotiation of an alternate view of scientific internationalism that focused less on establishing universal standards and creating centralized databases than on ensuring equitable access to expertise and resources.

Aspects of Scientific Practice/Organization | Global or Multilocal | 20th century, late | Conservation, environmental science, transnationalism, localism

The Delayed Arrival of the Future: The Case of General Mills’ Bontrae in Cold War America

Nadia Berenstein
Independent scholar

Much of mid-twentieth-century US food science and technology had a prospective and promissory orientation — one that combined dire forecasts of a food-scarce future with robust claims by industry to provide solutions that could mitigate the effects of the coming catastrophe. Such was the case with many of the novel protein-based food sources under development during wartime and in the postwar years, including chlorella algae, powders made from fisheries

bycatch, and plant-based protein products. But what happened when industry failed to commercialize on this research, or when consumers rejected these products in the marketplace? This paper will consider the case of General Mills' Bontrae, a unique "spun" soy protein product developed over more than a decade and at the cost of millions of dollars in R&D investment, only to vanish from the US market within a few years of its launch in the 1970s. This paper will tell the story of Bontrae's development and failure in the US marketplace in the 1960s and 1970s and its global afterlives. The story of Bontrae is not only about a consumer technology that flopped; it also has cultural implications for the technoscientific narrative of Malthusian crisis that justified, at least in part, its intensive development — and for our own era of promissory technologies. I will ask, what is the fate of the imagined futures embedded in failed technologies?

Theoretical Approaches to the Study of Science
| North America | 20th century, late

The Early History of the Nuclear Research Center SCK•CEN: Politics, Industry, Scientific Manpower and Nuclear Science in Belgium

Robert Van Leeuwen

KU Leuven; Belgian Nuclear Research
Center SCK•CEN

The major historical picture for the postwar nuclear landscape is the thesis of American 'co-produced hegemony' (Krige, 2008). According to this picture, the US government used its access to nuclear knowledge in order to both help postwar Europe rebuild its scientific infrastructure as well as securing US hegemony. More recently, however, the active role of European nations in the development of nuclear research infrastructure has been stressed by historians of science. The Belgian response to postwar nuclear research has until now received only scant attention from historians. This paper describes the early development of nuclear energy research in Belgium via Belgium's nuclear research center SCK•CEN, founded in 1952. To what extent can the domains of politics, industry and science be seen as independent in the construction of Belgium's nuclear research infrastructure? In which way was the training of nuclear scientists and

engineers, as well as the construction of nuclear technology, shaped through national and international politics? And how did this in turn affect the organization of nuclear science in Belgium/at the SCK•CEN?

Aspects of Scientific Practice/Organization | Europe | 20th century, late

The Exchange of Seismic Technology and Knowhow between USA and the Soviet Union, 1961-1965

Lif Lund Jacobsen
Danish National Archives

Designed to study earthquakes, seismographs was from the beginning of the 20th century installed across the globe. In the 1950s it became clear that global seismic monitoring was the most reliable method to detect underground nuclear tests. In 1961, M. Ewing of Columbia University was contacted by E. Savarensky of the Institute of Physics of the Earth, Moscow, who suggested that the two institutions exchanged seismographs on a scientific basis. The underlying interest was to gain access to the counterparty's technology to increase its own verification possibilities, a goal that could not be achieved through diplomatic

channels. By making it a question of scientific knowledge sharing, Soviet scientists hoped to gain access to sensitive US technology. Before agreeing, Ewing asked permission from political and military institutions, who concurred that the exchanges were as a matter of national security that would benefit USA more than the USSR. Over the next four years, the two regularly keeping in contact and, guided by their political and military hinterland, expanding the initial scope of the exchanges to include visits of scientists and experts. At times of high tension under the Cuba Missile Crisis, both parties used third-parties' like scientists from Denmark or international organisations like UNESCO, to further depoliticize the situation or act as a go-between. Based on material from USA, Denmark and Russia this study exam how science and scientists was used as diplomatic tools to facilitate nuclear test-ban negotiations and discuss the findings in the context of science diplomacy.

Aspects of Scientific Practice/Organization | Global or Multilocational | 20th century, late | Cold War, Nuclear Test Ban Treaty, Military funding, Seismology, Earth science

The French State and “Useful” Medical Knowledge: The Clinical Judgment of Guy-Crescent Fagon, Royal Physician to Louis XIV

Justin Rivest

University of Cambridge

My paper explores the role played by the king’s first physician (Premier médecin du roi) in organizing and evaluating a particular form of medical experimentation, namely, clinical trials of novel therapeutic substances. Although the primary responsibility of the first physician was supervising the health of the royal body, he also had a customary role in passing judgment on whether or not a given drug was safe or useful for the king’s subjects. This extended into the realm of state venality through the granting of royally-sponsored drug monopolies. As a case study, I examine the career of Louis XIV’s final first physician, Guy-Crescent Fagon (1638-1718), who organized patient trials and granted monopolies for dozens of drugs. Fagon was a graduate of the Paris Faculty of Medicine, superintendent of the Jardin du roi, and a member of the Académie des sciences, but the trials he organized were personally (rather than

institutionally) assessed and occurred outside of the auspices of these bodies. I argue that Fagon’s testing practices testify to the importance of embodied expertise, personal judgment, and authoritative witnessing by trusted practitioners. They also suggest a coherent research programme, one aimed at cheap, “useful” drugs that could be used indiscriminately by large populations in order to further the goals of the French state—particularly in military contexts—but they occurred outside of the institutional spheres that historians usually associate with state-sponsored science in this period.

Aspects of Scientific Practice/Organization | Europe | 17th century | Fagon, Medicine, Louis XIV, patents, drugs, jardin du roi, testing, expertise

The Future as We've Shown It: The Human Future in Space as Seen in Science Fiction

Matthew Shindell

Smithsonian National Air and Space Museum

Historians of the Space Age have pointed to the importance of space popularization, including the work of space illustrators like Chesley Bonestell and his contemporary science fiction authors and filmmakers, in selling a space future

to the American public. But what was this future, and who was allowed/expected to participate in it? If space was the next frontier, who would be the pioneers? And what alternative visions of space and the human future in space were available? Moreover, why has the field of space history tended to focus unreflexively on the white producers and consumers of space culture? This paper examines multiple visions of the future, and futurist images, to attempt to answer these questions. Going outside of the traditionally defined space literary canon, this paper also looks at Latino- and Afrofuturist images in an effort to expand our notion of the cultural meaning and value(s) of American space activity and exploration.

Social Sciences | North America | 20th century, late | Space, Futurism, Afrofuturism, Latinofuturism, Science Fiction, Popular Culture, Art

The Global Impact of Franco Basaglia and the Italian Radical Psychiatry Movement

John Foot

Historian, University of Bristol

Franco Basaglia was the acknowledged leader of a vast movement of psychiatrists, patients, administrators, students, politicians

and others to reform the psychiatric system in Italy in the 1960s and 1970s. This movement transformed individual asylums in Italy and the treatment of patients, and led to the 1978 180 Law (also known as the ‘Basaglia Law’), which eventually closed down the psychiatric hospital system entirely (although this ‘closure’ remains controversial at a number of levels). The impact of the ‘Basaglian movement’ and the 180 law was vast across the world, but very different from country to country and even from city to city. This paper will trace the different forms of acceptance, rejection and non-interest in a number of countries, drawing on research that will (in part) be published in a book co-edited by myself and Professor Tom Burns, to be published by OUP in 2019. This impact or non-impact will also shed light on the varying outcomes of the Italian experience itself, and the debates within Italy over the Basaglian legacy which are ongoing today.

Medicine and Health | Europe | 20th century, late | anti-psychiatry, deinstitutionalization, Italy, Basaglia

The Great Correlation Era in Astronomy

David Devorkin

Before astrophysics became truly physical in the 1920s, it was typically described as either "photographic" or "spectroscopic," where empirical mapping campaigns made it possible to intercompare the observed properties of the stars. From this effort, many correlations were established including the HR diagram, spectroscopic parallaxes, a mass-luminosity relation and a period-luminosity relation. But what did they mean?, some astronomers asked. Some speculated about what they implied about stellar development, or about the history of the structure and nature of the universe. But what did these correlations really mean, physically? And were they even real? We explore this question and explore how it resulted in the creation of modern astrophysical practice.

Physical Sciences | Europe | 20th century, early
| astronomy, astrophysics, cosmology

The Importance of Well-Proportioned Wholes: From Archytas' Division of Mathematics to Ptolemy's All-Emcompassing Philosophy

Cristian Tolsa

AvH Postdoc

The Inspiration Machine: Positive Pressure and the Boundaries of the Breathing Self

Oriana Walker

This paper traces a long-standing-- and perhaps surprising-- resistance to forcing air into the body. Brain death, organ transplantation, and complex life support all depend on positive pressure ventilators only developed post-war. But, already by the end of the nineteenth century, such machines were regularly breathing for a veritable Noah's Ark of German laboratory animals. A century earlier, in a pitch that failed, late eighteenth-century Humane Societies had attempted to promote positive pressure resuscitation, the forcing of air into an unconscious body against its natural pressure gradient, as modern; the ancients admitted no space between breathing life and unbreathing death, while moderns did. One of many protesting voices was Harvard Medical School founder Benjamin Waterhouse who replied in 1811 that the "bizarre and pernicious practice"

of blowing breath into the lungs could never give life to “dead matter.” From this time forward, every introduction of the seemingly ordinary (and perhaps urgent) act of forcing air into the lungs was rejected as soon as it was suggested. It was not until 1957 that mouth-to-mouth resuscitation completely replaced long-used and studied methods that involved compressing the chest to change its shape, causing air to passively flow in and out of the body. Why was there such persistent resistance to introducing ostensibly life-saving air into a dying body? What changed, allowing new kinds of ventilation technologies? And what did it have to do with changing boundaries of the self?

Medicine and Health | Global or Multilocational |
20th century, early | Medical technology,
animal-human boundary, defining the self

The Kangaroo and Other Natural Wonders: Picturing Pacific Exploration ca. 1770

Stephanie O'Rourke

Lecturer, University of St Andrews

In 1773, visitors crowded one of London's preeminent exhibition venues in order to see two recent paintings by George Stubbs.

Portraying a dingo and a kangaroo, these images were among the first to

depict recently-discovered Pacific flora and fauna for a European audience. Yet Stubbs – whose paintings of animals were valued for their anatomical precision rooted in direct observation – had never actually seen these creatures. The evidentiary authority of the images rested, instead, on their relation to the work of a rarely discussed but crucially important figure: the Scottish natural history illustrator Sydney Parkinson, who had died while serving as an artist on Captain Cook's first voyage to the Pacific. This paper examines the tension between observation and invention in the visual culture of scientific discovery from Cook's first expedition. The paintings and prints that circulated in Britain following Cook's return deployed a number of competing – and at times even contradictory – pictorial strategies to shore up their scientific credibility and to enhance their popular appeal. Situated between specimen and spectacle, this paper will show, these images created a framework for visualising Pacific exploration that shaped not only how British audiences imagined the remote region but also how scientific

knowledge about it was disseminated to a wider public.

Thematic Approaches to the Study of Science | Australasia/Oceania | 18th century

The Known and the Lived: Melitta Schiller-Stauffenberg

Daniela Helbig
University of Sydney

In the rapidly growing recent historical and literary scholarship on the genre of biography, a quote from Virginia Woolf has achieved classic status: "How can one make a life out of six cardboard boxes full of tailors' bills, love letters and old picture postcards?" It pointedly frames the biographer's unresolvable dilemma in terms of her sources. How to navigate between an empiricist faith in a subject speaking through these paper traces, and the constructivist awareness of the biographer's role in "making" this life? My contribution is concerned with how scientific practice changes the generic forms in which the biographical subject is traditionally taken to speak --- such as letters or diaries --- in the case of the German test pilot and physicist Melitta Schiller-Stauffenberg (1903-1945). The fragmented records of Schiller's life have left room for much biographical controversy about her work for the Luftwaffe as

a woman of Jewish descent, and her potential involvement in her husband's family's resistance to Hitler. Placing her diary and other texts in the context of the recording and note-taking practices that were developed as part of the professionalization of scientific test flying, I argue that the construal of Schiller's predicament in terms of politicized ethnicity alone leaves aside her own understanding of her work in aviation research as epistemically and morally meaningful. Hers is a case where biography can serve to examine how scientific practice shapes the practitioner by reconfiguring older cultural technologies of self-articulation.

Tools for Historians of Science | Europe | 20th century, early

The Languages of Sound: Pitch Data across Fields, Disciplines, and Nations in Europe and the United States (1877–1900)

Fanny Gribenski
Max Planck Institute for the History of Science, Berlin

Over the late eighteenth and the nineteenth century, classical music was increasingly perceived as a universal language in Western countries. At the same time, however, intensifying processes of

globalization and growing historical knowledge about the musical past revealed the plurality of musical systems in use across nations and time. In response to this complexification of the Western musical field, attempts were made to standardize pitch as a way of helping to regulate and secure such historical and geographical exchanges. Collections of pitch data, based on methods from the natural sciences, were a first step towards gaining control over tuning practices. But the production of this knowledge on pitch was embedded in different material, professional, scientific, and linguistic contexts, a diversity that challenged the universalist aims of pitch data collection and in some ways exacerbated the existing chaos in sonic and musical practices. Analyzing the epistemic struggles of two scholars (the British Alexander J. Ellis and the American Charles R. Cross) who attempted to create a unified language to represent and circulate pitch data in the late nineteenth century, my paper highlights the variety of disciplines—natural sciences, musicography, linguistics—involved in the production of acoustic knowledge at the time and their entanglement with their diverse

fields of application, whether musical performance, instrument making, or psychophysics.

Examining these intersections in a comparative and transnational perspective allows me to recover the political implications of pitch data and stress the significance of sound for the study of nationalism and internationalism.

Tools for Historians of Science | Europe | 19th century | History of Humanities, technology, sound, politics

The Lure and Corruption of Saturn in Sixteenth-Century Central European Mining and Metalworking

Tina Asmussen
ETH Zürich

This paper investigates the ambivalent character of Saturn in the context of sixteenth and early seventeenth literature on mining and metalworking in relation to desires, vices and virtues. The mythical figure Saturn, the son of Father Sky (Uranus) and Mother Earth (Gaia), was in medieval and renaissance alchemy and astrology related to the metal lead. As the last of the seven planets and in greatest distance to the sun he was qualified as dry and cold. In literature and art, he enjoyed an ambivalent reputation representing plenty and wealth but

also death, sexual violence (castration), cannibalism, and transience. He was perceived as the patron over the earth, woods and stones. Along with deviant figures—such as criminals, witches, magicians, frauds—miners and peasants were regularly depicted as the children of Saturn. Representing the changing fortunes of mining, he appeared as protagonist in allegorical mining festivals or as emblems on artworks and coins until the eighteenth century. Saturn in his dual nature as evil and promising figure is both an image of desire, offering wealth and affluence, and an image punishment, infamy and death. These characteristics turned him into an appropriate personification of the uncertain, dangerous, but at the same time promising mining industry. In order to analyze the promotion, provocation and management of desire in Renaissance natural philosophy, it is essential to consider economics and markets as well. In this sense, this paper seeks to qualify and continue Culianu's thoughts.

Earth and Environmental Sciences | Europe | Renaissance

The Making of a Science of Substance after Quantum Mechanics in Japan : the Emergence of "Busseiron" around 1940

Hiroto Kono

Tokyo Institute of Technology, Research Fellow of Japan Society for the Promotion of Science

It is well known that the appearance of quantum mechanics caused drastic changes in sciences of substance in many aspects, such as their methodologies, objects, and disciplines. By the mid of 20th century, some disciplines—solid-state physics, chemical physics, and quantum chemistry, for example—had been made in the field of sciences of substance. Given their rapid developments and significant impacts on the society, the sciences of substance have enough reasons to attract historical interests. In Japan, a discipline called "busseiron" was formed around 1940, and this was one of the emerging sciences of substance—studies or theories ("ron") of properties ("sei") of matter or substances ("butsu"). This newly formed science contained the contents from the various fields, such as statistical mechanics, solid-state physics, chemical physics, quantum chemistry, and so on, but corresponded to none of the above—

this discipline became an epistemological research frame unique to Japan; there is no word corresponding to "busseiron" in other languages. In this talk, I will briefly present the historical process of the formation of "busseiron", considering the context of making of sciences of substance after quantum mechanics—this formation was guided mainly by the physicists in the University of Tokyo under the strong influence of Japanese way to accept quantum mechanics and the tension among the existing research traditions, such as metallography, metallurgy, spectroscopy, nuclear physics, and so on.

Physical Sciences | East Asia | 20th century, early | physics, chemistry, solid-state physics, chemical physics, quantum chemistry, statistical mechanics

The Malay Kitab Tibb at the Intersection of Malay Medical Practices, Islamisation of Knowledge, and Colonial Medicine

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A recent exhibition of medical manuscripts at the Islamic Arts Museum Malaysia (IAMM) entitled *Al-Tibb: Healing Traditions in Islamic Medical Manuscripts*

successfully raised awareness of traditional healing among Malays featuring the museum's collection of Malay medical and divination manuscripts. Malay medicine and traditional healing are known to be a form of sacred knowledge and art that is usually passed down from one generation to another or to a trusted apprentice. The practice comprises using natural resources, spiritual practices, divination approaches, and Quranic verse recitations.

Manuscripts detailing this medical knowledge were still being produced and used when the British came to colonize the Malay Peninsula in the late nineteenth century. The start of concerted British efforts to understand the medical history and circumstances of the Malay peninsula in order to better extract resources saw efforts to collect local knowledge, prompting colonial administrators such as Richard Winstedt, John Gimlette and W. W. Skeat to record their experiences and perceptions of Malay medical practices inscribed in written manuals known as *Kitab Tibb Melayu* (Malay Book of Medicine) and *Kitab Faal* or *Kitab Ramalan* (Books on Divination). Contrary to seeing Malay medical practices solely as part of traditional

medicine, this paper situates Malay medical manuscripts or *Kitab Tibb* at the intersection of Malay, Islamic and colonial medicine. This paper will present some preliminary findings on situating the Malay *Kitab Tibb* in the fast changing medical and colonial environment of Malaya in the late nineteenth century.

Thematic Approaches to the Study of Science | Southeast Asia | 19th century | Malay medicine, colonialism, Islam

The Malingering Ear: Audiometric Surveillance in the Early Twentieth Century United States

J. Martin Vest
University of Michigan

In the late nineteenth century, new opportunities arose for practicing that most venerable and ancient of military arts—malingering. The expansion of workplace benefits made "playing sick" profitable in a range of new occupations while the growth of the workforce militated against close surveillance of sick workers and soldiers. Feigned deafness, in particular, presented a promising field of endeavor for the malingerer. The cacophonous modern battlefield and factory made hearing damage plausible and the technical demands of modern labor

meant it often unfitted one for duty. Most importantly, unilateral deafness was easy to fake and difficult to detect. This paper examines one front in the state's turn-of-the-century war on malingering—the use of hearing tests as a form of surveillance. Beginning around 1900 physicians associated with corporate and military employers developed audiometric techniques to sort malingers from those with genuine hearing damage. In so doing they participated in an intensification of the logic of surveillance, peering past workers' behaviors and utterances to probe directly the content of their sensory experience. In this respect, audiometry represents a close relative (and predecessor) of the polygraph.

Technology | North America | 20th century, early | surveillance, measurement, audiometry, hearing, sound, military, states, corporations

The Manifold Meanings of Nineteenth-Century Mathematics: Bernhard Riemann's Construction of the Manifold

Jenne O'Brien
Princeton University

This paper scrutinizes the revisions of mathematician Bernhard Riemann's (1822-1866) 1854

habilitation lecture at the University of Göttingen. It argues that the lecture is a reflection of how mathematicians developed non-Euclidean geometries in the nineteenth century, breaking with long-standing professional conventions and philosophical convictions in order to do so. Riemann's concept of the "manifold," which he presented in this lecture, was one of the most widespread non-Euclidean frameworks in the nineteenth century, and endures as a foundational concept in mathematics today. This paper argues that, while the manifold (and non-Euclidean geometry) was a "rupture," it was also continuous with the mathematical practices that came before it, including the study of minimal surfaces. More broadly, Riemann's papers reveal surprising aspects of mathematical practice, at exactly the moment when mathematics purportedly became abstract, immaterial, and unempirical. Riemann's mathematical research directly addressed questions of religion and metaphysics: he argued that the "world manifold" was the mechanism connecting human souls to the "world soul." And Riemann

described mathematics as though it could act, and act against him; he frequently was so captivated by his research that he could not pull himself away until he became physically ill. By using Riemann's revisions to temporally reconstruct the creation of the manifold, this paper challenges two narratives, one historiographical and one cultural: the myth of non-Euclidean geometry as a total rupture, and the notion that mathematics is immaterial and disembodied.

Mathematics | Europe | 19th century | mathematics, geometry, Bernhard Riemann, nineteenth century, Germany, Göttingen, theoretical sciences

The Mechanical Life of Plants in 17th-Century Natural Philosophy

Fabrizio Baldassarri
ICUB, University of Bucharest

In early modern time, vegetal bodies fell under the investigations of natural philosophers, who used plants as tools to investigate nature and, even, to propose an alternative interpretation of nature and overturn the Aristotelian ontology. René Descartes' mechanical philosophy of nature embodies one of these cases, as he considers plants nothing but living machines deprived of soul and constituted of particles of matter. Within this framework, vegetal

bodies are such as clocks or automata, i.e., self-maintaining machines. In this talk, I will inspect Descartes' interpretation of plants: the mechanical description of their internal structure and functioning in terms of particles and motion, the physiological explanation of their virtues and therapeutic uses, and their geometrical representation. In this case, I will also briefly span from what I consider Descartes' sources, such as Isaac Beeckman, and followers, such as Henricus Regius and Florent Schuyf. I will then compare Descartes' study of plants with Pierre Gassendi's atomistic interpretation of vegetal bodies and Thomas Hobbes' mechanization of vegetation. I will finally show how much these interpretations affected a mechanical study of plants in the second half of the seventeenth century, and especially in Nehemiah Grew, John Ray, and Marcello Malpighi.

Thematic Approaches to the Study of Science | Europe | 17th century | Descartes, Mechanization of nature, Gassendi, Hobbes, Malpighi, Grew, Ray

The Migration of Medical Dissertation Techniques from One Generation to the Next

Anja Goeing
Harvard University

By comparing 17th-century medical dissertations we can study how the strategies of disputation and dissertation changed and migrated from one generation of students to the next. My case study is the prolific thesis writer and supervisor Daniel Sennert (1572-1637), professor of medicine and alchemist at the university of Wittenberg. Among the more than one hundred dissertation students he supervised several went on to become professors themselves who supervised theses in turn. I will study the dissertations supervised by three of Sennert's intellectual offspring: Daniel Beckher (1594-1655) at the Prussian university of Regiomontanus or Königsberg (now Kaliningrad in Russia); Laurentius Eichstaedt (1596-1660) at the Academic Gymnasium of Gdansk in the Kingdom of Poland; and Werner Rolfinck (1599-1673) at the university of Jena (Duchy of Saxe-Weimar in the Holy Roman Empire). Comparing the theses supervised by Sennert with those supervised by these three student of

his brings to light changes and continuities in the methods of writing and orally defending theses in 17th-century European universities. We can expect that professors drew on their own experience in modelling oral performance for their students. The culture of academic performance permeated universities not only through the circulation of texts, but also through the geographical movement characteristic of many academic careers, including those of Sennert and these three students. My paper connects the development of early modern dissertation practices in medicine through the experiences of two generations of doctoral students defending their theses in the descendance of Daniel Sennert.

Aspects of Scientific Practice/Organization | Europe | 17th century | Student Migration, Scholar Migration, 17th century, Holy Roman Empire, Poland, Russia, Daniel Sennert, Werner Rolfinck, Laurentius Eichstaedt, Daniel Beckher, Dissertations, Medicine, Disputations

The Modeling of Alchemical Decknamen: On the Potential of Digital Representation for Deepening Understanding in the Humanities

Sarah Lang

Centre for Information Modelling (ZIM) of
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Alchemical language is an example of *scientia poetica*, its Decknamen are coded, ornate and instable. But alchemical language shouldn't remain ultimate riddle it has come to represent. Couldn't a computer bring clarity into the poetics of alchemy? After all, poetry is a system and systems can be modeled. Alchemical language is full of ambiguity but modern Digital Humanities tools allow to model exactly this uncertainty. Computational methods like Natural Language Processing (NLP), Named Entity Recognition (NER) and knowledge representation technologies, for example using thesauri of the terms of alchemy in SKOS-standard-conformant XML, allow to handle the typical ambiguity of alchemical data. We can make implicit instances of knowledge explicit in a digital thesaurus while the linking between the concrete word (a string or label) in a text to the thesaurus remains loose enough to allow for imprecise poetic language. Modeling

is the iterative process of systematic representation of certain aspects of reality. In order to model, we need make knowledge explicit. Once a model is created for the purpose of study, the failings of the model teach us new insights: Computational models are “temporary states in a process of coming to know”, in which computers are not “knowledge jukeboxes” but “representation machines” (McCarty 2004, 255). They create an systematic approximation of reality and from its shortcomings we learn about the reality we aimed to model. This paper aims to show uses of modeling alchemical terms in a digital thesaurus using the example of Michael Maier’s (1568-1622) writings.

Tools for Historians of Science | Europe | 17th century | Digital Humanities, knowledge representation, alchemical language, modeling

The Moon as It Should Have Been: Chesley Bonestell and the Pre-Apollo Lunar Landscape

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Even by the late 1950s, the easiest way to produce a clear image of outer-space was to have someone paint it by hand. In March of 1957, this was exactly how the Boston Science Museum presented visitors

with a new view of the lunar surface; installed in the Astronomical Exhibits lobby in front of the Hayden Planetarium, a sweeping ten-by-forty foot mural immersed visitors in a detailed recreation of the Moon’s topography. The mural was painted by America’s leading space illustrator, Chesley Bonestell, whose collaborations with well-known scientists lent his paintings a singular degree of technical credibility. However, the mural’s installation in the Boston Science Museum as a “scientific” view of the Moon would only temporarily be the case. In 1969, Apollo astronauts landed on the surface of the Moon and produced photographs that countered the dramatic topography described in the mural. This paper explores the conventions that helped the painting read as an authoritative view of the lunar surface in the pre-Apollo period, and the post-Apollo breakdown of these legitimizing elements. What functioned as an empirical representation of the Moon in 1957 was by 1969 recast as an artistic interpretation. Despite this revision, Chesley Bonestell’s depiction of the Moon’s surface was defended as scientific by some of his most famous contemporaries. I

explore how Bonestell's biography was edited to support claims about the empiricism of his work, and why this was useful to the scientists with which he collaborated.

Physical Sciences | North America | 20th century, late | Art, Astronomy, Lunar Exploration, Apollo Program

The Namban Screens and the Maps of the Relaciones Geográficas De Indias: Two Visual Representations of the Global Encounters in the Early Modern Europe

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In the history of the circulation of knowledge certain objects may be considered as paradigmatic of the ways through which information about territories and people was produced. The namban screens and the maps of the Relaciones Geográficas de Indias – RGI, both produced in the second half of the sixteenth century, provide two visual representations of the encounters resulting from the Spanish and Portuguese largescale empires. These two sets of objects brought novelty in the forms of representation of space used, and reflected particular relationships established between Europeans and

other cultures. The namban screens represent the nexus between Europe and the Orient; and the maps of the RGI the imperial territories of the Spanish Crown. Together they speak of a significant way of knowing and connecting the entire world. By associating the two instances, I argue that these visual and material objects are documents that allow for a clearer understanding of the early stages of European modernity since they both circulated within a network of data, visual representation, luxury, and power.

Tools for Historians of Science | Global or Multilocational | Cultural and cross-cultural contexts, including colonialism in general | Spanish and Portuguese empires, namban screens, colonial maps, Modernity, sixteenth-century

The Object of Secret Science: Censoring Hormone Herbicides in the Second World War

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In the final year of World War II, scientists advising the U.S. government on hormone herbicide research struggled to develop censorship practices that blended conventional modes of publication with the comparatively draconian model of atomic secrecy. Botanist Ezra J. Kraus encountered this

dilemma in his capacity as referee for the Advisory Committee on Scientific Publications (ACSP), under the aegis of the National Academy of Sciences. Officially, his task was to review manuscripts prior to their publication and to withhold those of military significance. In practice, particular features of hormone herbicide research, including its disciplinary affiliations and preexisting publication practices, rendered Kraus's project difficult. This paper examines Kraus's work with the ACSP in the context of his own herbicide research at the U.S. Department of Agriculture, chemical weapons research at Camp Detrick, and his advocacy of prompt publication following V-J Day. By restoring Kraus's project of censorship to its proper disciplinary and institutional context, I demonstrate that decisions on censorship were not exclusively questions of civilian versus military applications but rather intersected with a desire to preserve priority for military-contracted researchers after the war. These interlocking questions of dual use and priority claims came to characterize the 20th-century history of Agent Orange, the most infamous object of

Kraus's short-lived censorship committee.

Aspects of Scientific Practice/Organization | North America | 20th century, early | World War II, censorship, dual-use, Agent Orange, Advisory Committee on Scientific Publications, Ezra Kraus

The Outbreak Report as Paper Technology: Epidemiological Reasoning in the Early 20th Century

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The paper will introduce the outbreak report as an epidemiological paper technology. Since the late nineteenth century, epidemiology has not only developed statistical instruments and stochastic models, but the formalisation of the budding discipline included also the consolidation of a consistent narrative practice. As example for this paper serves a series of outbreak reports from the third plague pandemic from 1894 to 1952. The period coincides with the formative decades of formal epidemiology as an academic discipline. Outbreak reports were a genre of communication for and between epidemiologists. Each report aimed to cover the range of complex local

characteristics, which have turned a series of cases into an epidemic event. The reports collected general observations, individual case reports, mortality and morbidity statistics, brief descriptions of bacteriology, of treatment and prevention practices as well as of living conditions. They worked as places of explanation and cohesion for quantifiable data, such as case numbers, climate details or chronologies. But beyond their explanatory purpose, the reports did also reinstate and safeguard epidemiological practice as an empirical art, dedicated to fine-grained, systematic and inductive observation. The reports give deep insight into the historical formation of modern epidemiology as a broad interdisciplinary project, suspended between historical, anthropological, sociological, statistical, and medical approaches to disease. Furthermore, my paper will show that the narrative structure of the reports also sustained epidemiological reasoning as an inductive practice, based on the correlation of an open-ended range of data and perspectives, and

often indifferent to questions of causation.

Medicine and Health | Global or Multilocational | 20th century, early | Epidemiology, public health, paper technology, casuistry, plague

The Overcoming of the Cartesian Paradigm in Physiology: The Case of Burchard de Volder

Andrea Strazzoni

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Descartes' medical reception can be separated into several phases in the seventeenth century, starting with its first introduction and extending to its sophisticated refinements. This talk examines a final moment in its reception in the Low Countries in the work of the Leiden professor Theodoor Craanen who can be credited with bringing to the fore the consequences of Descartes' reduction of physiological phenomena to the interaction of invisible particles. Craanen's fellow Leiden professor Burchard de Volder, most famous for opening the first experimental cabinet in a European University, forcefully criticized Craanen's reductive approach as "speculative". As an alternative, De Volder proposed an experimental-mathematical approach to medical questions that

was firmly rooted to the consideration of visible processes only, and on their interpretation in the light of mechanical principles. The treatment of respiration is a case in point, figuring prominently in this polemical exchange. If, on the one hand, the standard Cartesian treatment of respiration was based on the circular thrust of air caused by the dilatation of the thorax moved by animal spirits, De Volder proposed an account based on the elasticity of the air and on the law of Boyle-Mariotte whereby the lungs are inflated and deflated by different conditions of pressure within and outside them. By examining the dispute between Craanen and De Volder we can learn how one extreme of medical Cartesianism met resistance in the Netherlands and how English virtuosi played a hand in this resistance.

Thematic Approaches to the Study of Science | Europe | 17th century | Craanen, De Volder, Experimental Philosophy, Reductionism, Leiden

The Pacific's Black Current: China, Japan, and the "Cooperative Study of the Kuroshio and Adjacent Regions" (CSK), 1965-1978

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The Kuroshio—literally known as the “black current”—is the Pacific counterpart of the Gulf Stream in the North Atlantic. It is a west-to-east flowing warm current in the Northeast Pacific region. During the Cold War, a 13-year international program known as the “Cooperative Study of the Kuroshio and Adjacent Regions” (CSK) was launched between 1965-1978, incorporating participation from British Hong Kong, (Republic of) China, Japan, Vietnam, the Philippines, Korea, the US, and the USSR. This paper explores the complexity of scientific cooperation manifested in the divergent interests held by Chinese and Japanese scientists in the CSK. Just as Japanese oceanographers held different sets of concerns and expectation over the CSK than their Soviet counterparts, the Chinese delegates of the CSK also expressed different interests than their Japanese colleagues. Through studying the national differences in the international survey of the

Pacific current, this paper aims to shed light on the politics of oceanographic internationalism as intertwined along the Pacific coasts. I argue that the participation of China and Japan in the mid-twentieth century study of the Kuroshio seem to highlight their divergent commitments and motivation in approaching the Pacific's black current.

Thematic Approaches to the Study of Science | East Asia | 20th century, late | Cooperative Study of the Kuroshio and Adjacent Regions (CSK), the Pacific, the politics of international cooperation, global Cold War

The Places of the Sun, Mercury, and Venus: Diagrammatic Innovation in Medieval and Renaissance Planetary Order

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Independent scholar

Pre-modern celestial observers had difficulty understanding the positions of the sun, Mercury, and Venus in a geocentric planetary order. Prominent ancients – Plato, Aristotle, Archimedes, Cicero, and Ptolemy – were inconsistent in their statements regarding the placement of the inferior planets. The same misunderstandings carried over into a plethora of medieval and Renaissance Latin manuscripts. The modern historian faces the question

of how these later astronomy authors of the ninth through the seventeenth centuries diagrammatically responded to the planetary uncertainty? The answer, in many instances, was with innovation. By discussing several of these celestial diagrams, this paper demonstrates that attempts to adjudicate planetary locations resulted in a variety of novel planetary configurations: circumsolar epicycles, double and triple intersecting orbits, and implied epicycle-on-deferent schemes. Of particular focus for this presentation were unusual epicycle-on-epicycle arrangements for Mercury and Venus, which permitted a large variety of planetary orders to ensue. These planetary arrangements evolved from the fifth-century writings of Martianus Capella and Macrobius. The former sought to reconcile the ancient misgivings by suggesting that Mercury and Venus traveled in circumsolar epicycles, while the latter was widely (but perhaps incorrectly) interpreted to suggest intersecting planetary circles. These diagrams greatly impacted medieval and Renaissance ideas on planetary arrangements, including those of Copernicus. He explicitly acknowledged the role of Capella – and other Latin writers –

in developing a sun-centered system that relegated the earth to planetary status.

Physical Sciences | Europe | Medieval | planetary order, medieval diagrams, circumsolar Mercury and Venus

The Polemic between Pierre Gassendi and Jean Baptiste Morin on Galileism, Copernicanism, and Galileian Astrology

Rodolfo Garau

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EarlyModernCosmology

The polemic between Pierre Gassendi (1592-1655) and the astrologer and mathematician Jean-Baptiste Morin (1591-1659) – which followed the publication of Gassendi's "Galileian" letters *De motu impresso a motore translato* in 1642 – is widely regarded as a defining moment for the destiny of astrology in early modern France. It is believed to have marked a "public execution," and the subsequent progressive passing of astrology from modern scientific discourse. Less emphasis has been paid, however, to the significance of such debates in the establishment of Galileian science in early modern France. This presentation reconstructs the phases of this debate, and argues that they show

the numerous turns in the fortune and acceptance of Galieian-inspired astronomy, on the one hand, and of astrology, on the other, as well as the strategies that each of the historical actors had to put in place to overcome censorship (or worse) and to credit themselves as legitimate "scientists."

Thematic Approaches to the Study of Science | Europe | 17th century | History of Astrology, History of Astronomy, Galileo

The Politics of Botanical Objecthood in Nineteenth Century Correspondence Networks

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In December of 1822, Danish naturalist Nathaniel Wallich (1786-1854) left his home in Kolkata, and visited British colleagues in Bengkulu and Singapore on a collecting mission that was designed to unite the flora of the East Indies and India. During his months abroad, Wallich collected thousands of plants in the East Indies, transported them both alive and dead back to India, and shipped out sample sets and descriptions to Britain, France, and the Netherlands. Wallich's objectification of these tropical plants functioned as a way of managing and facilitating global

trade, even amidst the Napoleonic Wars, which enabled him to continue building natural history institutions within South and Southeast Asia. The process both exploited and complicated colonial competition. The history of botany has largely been told as a circulation of goods between “center and periphery” or, in more recent studies, between colonial botanic gardens that upheld imperial structures. The realities of collecting in situ, however, present a far more complicated story: one in which middle-class practitioners worked across national alignments, sometimes double- and triple-timing their patrons in supplying rivals with duplicates and triplicates of specimens. Indeed, many of these “professional” collectors occupied liminal spaces alongside their indigenous colleagues, acting as political prisoners, commercial nurserymen, and illustrators for hire. Pairing circulating herbarium specimens with correspondence records and the glass and paper technologies that accompanied them, I trace the complex networks of “global” botanical transfer and communication across the Indian

Ocean in the early-nineteenth century.

Aspects of Scientific Practice/Organization | Global or Multilocational | 19th century | Botany, Natural History, Science and Empire, Collecting, Globality, Correspondence, Circulation, Material Culture

The Politics of Future Images: Visions of the Future in Dutch Scientific Advisory Councils, 1967-1980

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During the height of the Cold War, the future as an object of scientific inquiry gained traction among both Western and Eastern nations, resulting in new fields such as future studies. Yet future studies was a motley field with a variety of techniques, conceptions of the future, and political vision. The relation between state and science; between science, democracy and citizenship were constantly at stake in the images of the future that future studies provided. This paper takes a look at the institutionalization of scientific expertise on the future in the Netherlands from 1967 to 1980, and investigates the ideas on democracy, citizenship and state planning present in the competing imaginaries of the future at the time. By

investigating the different modeling techniques of the different future research group active in the Netherlands during that period, I will argue that these ideas were intrinsic to the scientific practices of future researchers. Modeling was instrumental for forming images of the future, while the politics of future images informed the modeling practices. I will thus try to show that different research groups with different models also adhered to different political ideals. At the end of the paper, I want to shed some light how future research has influenced the organization of advisory councils and policy analysis by considering how modeling techniques from the 60s and 70s have been repurposed to fit neoliberal agendas.

Social Sciences | Europe | 20th century, late |
Future Studies, Scientific Expertise, Democracy,
Modeling, Images of Science

The Power of Phosphate: Energy and the "Cellular Economy" in Twentieth-Century Biochemistry

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This paper will examine an oft-overlooked development in the history of twentieth-century biology: the rise of bioenergetics, or the study of energy transformations in living

organisms. Through a case study of the work of biochemist Fritz Albert Lipmann and his associates, this paper will describe the changing role of the molecule adenosine triphosphate (ATP) in bioenergetic research. In the course of his work on phosphate metabolism, Lipmann developed the notion of the “high-energy” or “energy-rich” phosphate bond, which he symbolized by the “squiggle” notation, or $\sim P$.

According to Lipmann, $\sim P$'s stored large amounts of energy that could be released when these bonds were broken; for example, in a molecule of ATP, which has three phosphate groups next to each other.

Lipmann's work on $\sim P$ suggested that energy from carbohydrate breakdown could be “captured” in the phosphoanhydride bonds of ATP, which biochemists increasingly began to refer to as the universal “energy currency” of the cell. The “currency” of ATP circulated within a metaphorical “cellular economy,” in which energy-requiring metabolic reactions were often linked to energy-releasing metabolic reactions.

Building upon recent work on the history of metabolism, this paper aims to articulate a new interpretation of twentieth-century

biology by arguing that the bioenergetic metaphor of the “cellular economy” shaped the development of modern biology in ways distinct from the metaphor of “genetic information,” which has received a great deal of historiographical attention.

Biology | Global or Multilocational | 20th century, early | Biochemistry, Cell Biology, Bioenergetics, Metabolism, Metaphor in science

The Radical Sexual Biology of Magnus Hirschfeld

Tom Butcher

Tom Butcher, University of Virginia

In recent years, thanks to scholarship from Wolff, Mancini, Bauer, and others, the sexologist and gay rights activist Magnus Hirschfeld has returned from obscurity to claim a place at the forefront of European LGBT history. But, with the major exception of Sengoopta’s work, Hirschfeld is less prominent in recent histories of twentieth-century science. This uneven development in Hirschfeld’s historiographical presence is unfortunate, as it implies that his science was somehow secondary to his activism, rather than intimately intertwined with it. In this paper I will offer a partial corrective to this trend by arguing that Hirschfeld’s work can be best

understood as an attempt to create a radical conception of sex in which all existing people are considered to be sexually intermediate (between male and female) in one form or another. This theory simultaneously normalized the bodies of sexual minorities (such as homosexuals and transvestites) and complicated the bodies of heterosexuals. As I will argue, Hirschfeld was guided by two occasionally opposed intellectual aims: toward categorization, and toward individualization. In putting forward his theory, he sought simultaneously to explain the existence of any given sexual variation within a system of biological masculinity and femininity; and also to emphasize the unique nature of every person’s sexual configuration. It was because of this uneasy alliance of aims that Hirschfeld’s theory could become a potent political tool. In Foucauldian terms, Hirschfeld used his theory to create sexual knowledge, and thus bio-power, which he then leveraged for the purposes of sexual liberation.

Biology | Europe | 20th century, early | Sexology, sex, gender, sexuality, biology

The Right Kind of Experience: Physicians, Empirics, and Poison Trials

Alisha Rankin
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This paper will examine sixteenth-century physicians' attempts to portray contrived tests of poison antidotes as a learned endeavor. Poison trials had long been used by charlatans and other empirics, who hawked their nostrums in marketplace shows that involved self-poisoning and poisoning animals. From the 1520s, however, some physicians began to test antidotes using poison on condemned criminals – first at the papal court in Rome and then at other European courts. Their newfound interest in poison trials invited comparison with empirical practitioners' marketplace shows. Physicians thus came up with deliberate narrative strategies to differentiate their trials from empirical practitioners' "misguided" tests. One strategy involved explicit contrast between physicians' tests and the fraudulent shows put on by "itinerant country swindlers," in the words of German physician Eurichus Cordus (1540). More subtly, physicians penned detailed accounts of poison trials that

included careful markers of their learning, such as references to the hours of the clock, pulse checks, and allusions to learned medical theory. They described these trials using scholarly terms designating experience, such as *historia*, *observatio*, or *experimentum*. Some of these accounts were recorded privately; others circulated at courts; and still others were shared publicly, such as Pietro Andrea Mattioli's detailed account of a poison trial in his popular commentary on Dioscorides. The similarity between these documents, however, suggests a conscious narrative of a "right" way to conduct contrived medical trials with poison.

Medicine and Health | Europe | Renaissance | Experiment, experience, poison, trial, physicians, print culture, medicine,

The Rise of a Utilitarian Concern in Seventeenth-Century Moon-Mapping: The Case of Giovanni Domenico Cassini's Grande Carte de la Lune (1679)

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University of Geneva / University Paris-Nanterre

After Galileo's remarkable demonstration of the rugged surface of the moon, several attempts to provide a comprehensive cartography were conducted,

culminating with Johannes Hevelius's lavish *Selenographia* (1647). By representing each phase of the moon, Hevelius did not only intend to give an accurate description of the satellite, but also to provide a detailed physical explanation of its behaviour. Such a clear purpose contrasts with the *Grande Carte de la Lune* completed thirty years later in the Royal Academy of Sciences. The project, directed by Giovanni Domenico Cassini, began in the early 1670s, soon after the construction of the Observatory. Once achieved, the map was deemed the most precise ever done, and yet its purpose and application have hitherto remained mysterious. While the print was directly financed by the *Surintendance des Bâtiments du Roy*, the few scarce copies retained in public collections lack any dedication or legend, suggesting that the project was not deemed as desirable as it may have been at the beginning. Indeed, a few years later, Cassini felt compelled to justify the usefulness of moon-mapping. Through the careful analysis of the fabrication and reception of the *Grande Carte de la Lune*, I hope to detail the shift from a conception of science closely associated to courtly

practices to a more utilitarian view. I will then attempt to discuss how such a shift was partly determined by the economic policy of the *Bâtiments du Roy*, but also by internal conflicts within the Academy.

Aspects of Scientific Practice/Organization | Europe | 17th century | Moon-mapping, Giovanni Domenico Cassini, Royal Academy of sciences, utilitarian conception of science

The Role of International Journals in Epistemic, Political, and Community-Building Processes in Postwar Science: BBA's Celebration Volume of 1989

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For more than two hundred years after the origin of the learned journal, the modes of scholarly communication remained highly diverse. Only in the later nineteenth century did the scientific paper achieve privileged status. It took another half century before the formats and uses of scientific journals began to fully correspond to contemporary conceptions of scientific publishing. Those journals, "invented" after World War II by commercial publishers rather than scientific societies, had specialized orientations, international editorial

boards, established peer-review procedures and relatively fast publication schedules. Due to these features, they were more apt than their forebears to provide analysis of scientific fields and developments, direct those developments through categorization and selection, bring about social cohesion, and negotiate meanings and social rules. As scholars have only recently begun to approach questions regarding the nature and legitimacy of science from the perspective of changing communication formats, the (twentieth-century) scientific journal has not yet received much attention as a social institution. By presenting the case study of *Biochimica et Biophysica Acta* (BBA), founded in 1946 at Elsevier, this paper probes into the role of international journals in epistemic, political and community-building processes in postwar science. It also explores the role of commemorative practices in the performance of journals as social institutions, specifically the 1000th volume of BBA, published in 1989 as a celebration volume with reprints of “particularly significant articles”. This paper argues that journals sometimes invoked the commemorated past to serve conceptual, institutional, social, and

political agendas in the commemorating present.

Aspects of Scientific Practice/Organization | Europe | 20th century, late

The Schenberg’s Work and the Beginning of Physics Research in Brazil: Political Context, Institutional Projects, and Dynamics of Knowledge Production

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University of São Paulo

The main purpose of this study is to analyze the first researches in Physics held at the University of São Paulo (USP), an institution that would become a reference in Brazil. Three important dimensions that characterize the episode are considered: i) The Sociopolitical Context: São Paulo's political and economic elite seeks to restore this state as the most influential of the nation; ii) The Institutional Context: The first generation of USP intellectuals was formed from the missions in Europe led by Theodoro Ramos. The Italian mission first brought Gleb Wataghin to Brazil and, four years later, Giuseppe Occialini; iii) The Scientific Context: the arrival of foreign professors inserts USP in a context of international circulation of knowledge. Cosmic rays, a

prominent theme in the researches carried out, are of worldwide relevance to Nuclear Physics. The development of the research is based on documentation of the Physics Institute archive, focusing mainly on the initial work of Mario Schenberg, first physics full professor. A narrative that seeks to make evident tensions between the three presented dimensions is established as the main result. Seeking to move away from a linear narrative that establishes very immediate causalities between historical occurrences, the work shows that the dynamics of knowledge production carried out at USP oscillate between works that seek to place Physics in an international context and others that try to establish dialogues with the traditions previously present, especially the works produced by engineers.

Physical Sciences | Latin America | 20th century, early | Physics in Brazil, Mario Schenberg, Cosmic Rays, Mechanics

The Scientific 'Centrality' of a 'Peripheral' Laboratory: The University of Coimbra Experimental Phonetics Laboratory (1936-72)

Quintino Lopes

Institute for Contemporary History [New University of Lisbon; University of Évora]

The aim of this paper is to provide a contribution to the historiographic agenda regarding the idea of the circulation of knowledge, the Global History of Knowledge and the debate surrounding scientific 'centres' and 'peripheries' (1, 2). We examine the University of Coimbra Laboratory of Experimental Phonetics (1936-72), traditionally regarded as 'peripheral' space, but which nevertheless attracted scientists from all over Europe, the USA, Brazil and Africa seeking specialist training. This phenomenon contributed to the development of teaching and research at other 'peripheral' laboratory spaces (for example, the University of Bahia) and at 'central' scientific institutions (for example, Harvard University). With the growing trend in historiography for the recognition of 'invisible technicians' (3) and 'outsiders' (4) in the production and circulation of knowledge, there is a need for surveying the work of this Portuguese laboratory, whose

director, Armando de Lacerda, created new research tools in the field of Experimental Phonetics which were appropriated by institutions and scientists on both sides of the Atlantic. 1) James A. Secord, 'Knowledge in Transit', *Isis* (2004) 95, pp. 654-672. 2) Mark Thurner, 'Historical Theory Through a Peruvian Looking Glass', *History and Theory* (2015) 53, pp. 27-45. 3) Steven Shapin, 'The Invisible Technician', *American Scientist* (1989) 77, pp. 554-563. 4) Richard Drayton and David Motadel, 'Discussion: the futures of global history', *Journal of Global History* (2018) 13, pp. 1-21.

Aspects of Scientific Practice/Organization | Global or Multilocal | 20th century, early | Global History of Knowledge, Scientific 'centres' and 'peripheries', circulation of knowledge

The Slow Appearance of Radiation Risk Perception

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After the discovery of X rays and radioactive elements in the turn of the 19th century, the deleterious health effects of radiation were greatly ignored. Most experiments regarding the physiological effects of radiation were about the possibilities of their therapeutic use. Radiation widespread application in

medicine, along with its use in entertainment, beauty and other industries rapidly unveiled radiation hazards such as skin burns, cancer and ultimately death. Nonetheless, factors such as the immediacy, certainty, transparency and obviousness of the benefits of radiation applications, together with people's confirmatory bias, delayed the appearance of radiation risk perception among the scientists and the public. Perception about radiation thus went through an evolving process with varying velocities, from an unknown phenomenon to suddenly being a miraculous cure of all ailments and then from being a danger, in the sense of something that is out of people's control, to entailing a risk that can be measured and prevented through implementation of protective actions. Today, radiation risk is one of the most thoroughly studied among all health risks. The present proposal intends to give a snapshot of what experts knew about radiation risk during the initial stages of research and use of ionizing radiation. Finally, the talk aims to show briefly the evolution of the scientific knowledge about

radiation risk illustrated by dose limits.

Medicine and Health | Europe | 19th century | risk perception, ionizing radiation, radioactivity, dose limits

The Smell of the Sick: Odor in Eighteenth-Century French Medicine

Abigail Fields

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Eighteenth-century France was marked by distinctly “odored” phenomena. The rise of industry led to the emission of mephitic aerial pollutants while disease outbreaks caused an overcrowding of hospitals, which became noxious institutions in many cities. These smelly realities and the anxieties that they provoked led to an increased attention to atmospheric aromas and personal bodily odors. While French cultural historians such as Alain Corbin (*Le Miasme et la Jonquille*, 1982) and Robert Muchembled (*La Civilisation des Odeurs*, 2017) have studied scent and smell during this period, the topic has been largely ignored by historians of science and medicine. This lacuna is striking, given that the medical literature from this period demonstrates a heightened concern with the importance of odor and odorants in medical practice. The use of odor in

medicine participated in a medical epistemology that interfaced with contemporary theories and experiments on air quality and composition in relation to human health. In this paper, I explore the ways in which scent figured into medical thought, and the social ramifications of this development. My analysis centers on the relationship between odor and disease, focusing on (1) the role of odor in explaining the cause of diseases, (2) the importance of odor as a symptom in disease diagnosis, and (3) aromatic and olfactory treatments of diseases that were supported in the period. I conclude by showing how representations of odor helped to define what it meant to be healthy and normal in eighteenth-century France, in the medical realm and beyond.

Medicine and Health | Europe | 18th century | France, medicine, sensory science

The Species Transmutation Debate and Agricultural Science in the Antebellum United States, 1820-1859

Anahita Rouyan

Independent researcher & consultant

The paper traces a debate about species transmutation that unfolded in agricultural periodicals published

in the Northeastern United States between 1820 and 1859. During the nineteenth century, numerous members of New England farming communities believed that particular environmental conditions could prompt wheat seeds to produce a variety of weed called cheat or chess. The widespread belief in the “transmutation” of wheat into chess was mobilized by testimonies shared by farmers in letters to agricultural periodicals where the topic was widely debated. The group of agricultural reformers that curated the content of these publications at the time promoted agricultural improvement by disseminating knowledge about relevant science and technology topics. The widespread discussion about the transmutation of wheat offered these editors an opportunity for sharing scientific knowledge about plant heredity and botanical classification systems, encouraging experimentation among audiences prejudiced against “book farming.” In their assessment of the theoretical contributions of botanists and practical experiments conducted by farmers, the reformers negotiated the authority of scientific expertise in the study of nature and delineated standards of scientific inquiry into

agricultural matters. Their engagement with the transmutation debate contributed to the democratization and professionalization of agrarian improvement, laying the groundwork for the activities of agricultural research institutions that emerged in the second half of the nineteenth century.

Biology | North America | 19th century | evolution, agricultural science, botany, science popularization, agricultural periodicals

The Struggle Over Politicized Scientific Facts in a Post-Truth Age: The Union of Concerned Scientists’ Altercations with Presidential Science Advisors, 1969-2008

Julia Marino
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Who defines the terms of American public discussion over science issues such as nuclear policy, healthcare, and climate change? Exploring the conflicts between presidential Science Advisors and the Union of Concerned Scientists between 1969 and 2008 provides a window into this question. During the Nixon administration, the president’s Science Advisor shifted from serving as a technical expert in the executive branch to working primarily as a public relations

spokesman, bolstering the president's credibility as an objective scientific voice in the public eye. The Union of Concerned Scientists (UCS), a group of researchers, emerged in 1969 at MIT to protest the militaristic policies of the Nixon administration and criticized Science Advisor Lee Dubridge. The UCS was a continuous thorn in the side of subsequent presidential administrations and competed with the Science Advisor to set the terms of public debates over science. Historians have not fully explored the role of Science Advisors and the Union of Concerned Scientists since the Nixon administration and instead have focused largely on the role of Science Advisors in the early Cold War period. Drawing on archival material from five different repositories, this flashtalk will explore three specific instances of conflict between the Union of Concerned Scientists and the presidential Science Advisor in the Richard Nixon, Ronald Reagan, and George W. Bush administrations over nuclear policy, the Strategic Defense Initiative, and climate change respectively. I argue that Science Advisors and the UCS have competed to shape public language

and priorities for science in the past fifty years.

Physical Sciences | North America | 20th century, late

The Synthetic and the Natural in Chemical Control in the United States and Europe

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In the twentieth century, the proliferation of synthetic chemicals prompted US and European governments to introduce regulatory regimes for the control of chemicals. It was especially consumers' concerns about artificial food additives and synthetic pesticides that inspired environmentalism and prompted a wave of environmental regulations in the postwar decades. However, aflatoxin, a mold-produced carcinogen, has challenged scientists' and regulators' notions of toxic substances and control ever since its discovery in 1960. This paper describes how scientists of the US Food and Drug Administration (FDA) and the Scientific Committee on Food of the European Commission studied this "naturally-occurring" toxic substance and developed regulatory strategies from 1960 to the early 1990s. The agencies quickly devised ways to

classify and regulate aflatoxin within the legal frameworks for synthetic contaminants. In the early 1980s, Bruce Ames challenged the whole regulatory framework by arguing that the health effects of synthetic chemicals were insignificant compared to the ones of unavoidable natural toxins, such as aflatoxin. In the meantime, agricultural scientists had shown that the formation of aflatoxin depended as much on human agricultural practices as on environmental conditions. This paper analyzes when, how, and why Ames, Philippe Shubik, René Truhaut, and other key figures evoked aflatoxin's naturalness. The paper argues that evoking the difference between synthetic and natural chemicals served the justification and legitimacy of regulations at specific points, rather than reflecting different ontologies or research practices in the study of toxic substances

Chemistry | Global or Multilocational | 20th century, late

The Synthetic Illness: Mescaline Intoxication and Schizophrenia, ca. 1920-50

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The common tale about the “chemical revolution” in psychiatry is that it begins with the introduction of neuroleptics in the 1950s. The latter led, as most historians argue, to the dismantling of mental asylums: patients suffering from mental illnesses were increasingly treated as out-patients. This paper starts from a different standpoint. It discusses a series of works that were published in an era that predates the so-called “chemical revolution”: the first half of the twentieth century. The paper argues that the foundation of chemical interpretations of mental illness (and pharmacological treatment) was laid in the interwar period within clinical and experimental studies with mescaline. Research on the alkaloid mescaline, extracted from peyote and first synthesised in 1919, focused from the early twentieth century on possible analogies between mescaline intoxication and psychosis. This led to claims that biochemical or hormonal imbalances were the cause of mental illness (illustrated in particular with the

example of schizophrenia and the so-called "m substance" in 1952). Focusing on published works by psychiatrists and neuroscientists (i.e. John Raymond Smythies, Humphrey Osmond, Roland Fischer, Kurt Beringer, Heinrich Klüver), the paper highlights the determinant role that biochemistry played for brain-centered explanations of mental illness, and conceptions of personality. It furthermore discusses how the senses (in particular eyesight) were examined in experiments to further the clinical association between mescaline intoxication and schizophrenia

Medicine and Health

The Travails of Traveling Natural History Artists

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This paper explores the material conditions under which two English artists, John Abbot and John William Lewin, produced magnificent entomological drawings in foreign settings. In the 1770s Abbot travelled to southeastern backwoods of North America and Lewin travelled in the 1790s to Australia. Although Abbot and Lewin did not know each other, their stories are joined by their

association with Dru Drury, a jeweler and amateur entomologist, who sponsored both artists' journeys. These artists worked in difficult conditions, including rugged terrain, political instability, illness, isolation, and the scarcity of art supplies, all of which put stress on their job of depicting as accurately as possible arthropods found in remote and exotic locales. Even small annoying things like flies eating the paint off watercolor drawings disrupted the art-making process. Perhaps the biggest obstacle to producing entomological drawings was the necessity of building an extensive insect collection. Lewin and Abbot had to become specimen hunters as well as accomplished artists and field naturalists. Both Abbot and Lewin were ambitious and planned to return to London to publish their drawings as illustrated natural history books, following the tradition established by Maria Sibylla Merian and Mark Catesby. However, neither artist returned to Britain, and their paths to publication turned out to be much more difficult than they had expected. This paper describes how these artists produced art in British imperial outposts and how this

artwork fared as it travelled through global networks of exchange.

Biology | Global or Multilocational | 18th century
| Entomology, Art, Illustration, Travel,
Colonialism

The Urge to Gloss: Multilingualism in the Making of Ṭibb

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Manuscripts of medical texts composed in medieval and early modern South Asia frequently included glossaries (“farhang”) of technical terminology. These were structured around entries for disease categories in Arabic, with translations in Persian and “hindī” (vernacular South Asian languages). Medical glossaries, titled “farhang-i ṭibb,” or less commonly “lughat-i ṭibb,” were part of a broader literary practice of producing farhangs in Persian literature. Glossaries were composed to accompany a variety of texts, from the Quran to epics of poetry. The medical glossaries were iteratively produced through reading, citation, medical practice and writing. Translation in these glossaries is not just the “transfer” of knowledge from one language to another; rather, it acknowledges the continued use of multiple languages, and enables readers with different

kinds of linguistic skills. I draw on manuscripts of medical texts composed between the 14th and 16th centuries in Yemen and India to investigate the iterative and collaborative process through which these glossaries were produced -- and their role in the formation of the medical tradition known as “ṭibb.” Modern scholarship on ṭibb, called Graeco-Arabic or Islamic medicine, has focused on texts composed in Arabic in the Near East. However, this focus neglects the life of ṭibb around the Indian Ocean World, where it underwent some of its most lasting developments. By analyzing the profusion of multilingual glossaries transmission from the western Indian Ocean World, I aim to understand ṭibb across a fuller geography, in which physicians worked continuously across linguistic regimes to pursue efficacious knowledge.

Medicine and Health | Global or Multilocational |
Medieval

The Use of Sensory Stimuli in Linguistic Fieldwork

Judith Kaplan

University of Pennsylvania

The 1874 edition of Notes and Queries on Anthropology was written, like other such protocols of

the nineteenth century, “to promote accurate anthropological observation on the part of travelers,” enabling those who were not “anthropologists themselves to supply the information...wanted for the scientific study of anthropology at home.” It was an attempt to discipline a potentially unruly observer—officers, administrators, missionaries—one who was nevertheless charged with collecting the ‘raw data’ of anthropology. But new disciplinary constellations, methodological norms, and attitudes toward experimental subjects, were beginning to shift the ways in which questions were asked and answered during this period. Increasingly, emphasis moved from the observer to the observed, corresponding to a raft of new fieldwork instruments that engaged experiences across the sensorium. This presentation will focus on exchanges between students of language, culture, and the mind, attending to practices of interrogation that eschewed the use of language—spools of yarn, color chips, illustrated flip books, naturalia, and the like. As this partial list already suggests, attempts to innovate assays of the mind that were not mediated by translation brought anthropologists and

linguists into unlikely collaborations with artists, industry, and other scientific disciplines. While highlighting the networks that gave rise to these tools, the presentation will simultaneously trace theoretical implications for how researchers conceptualized correspondences between linguistic forms, concepts, and things in the world.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 19th century

The Visual Culture of Alfonsine Astronomy: The Case of Getty Museum, Ludwig XII.7

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The constellations pictured in the manuscripts commissioned by ‘Alfonso X el Sabio’ (Lapidario, El Escorial, RBME, Ms. h-I-15, Libro del saber de astrología, Madrid, UCM BH, Ms. 156, Libro de astromagia, Città del Vaticano, BAV, Ms. Reg. Lat. 1283a) stem from the figurative cycle illustrating the text of al-Sufi’s *Kitab Al-Kawakeb Al-Thabita*, the Book of the Fixed Stars. This repertoire adapted Classical representations of the constellations, adding specific elements from the Islamic and the Bedouin tradition. Al-Sufi’s forms also changed the Classical aesthetic

and attributes and adapted them to the Eastern fashion, just as the figures of the Alfonsine manuscripts later added a Western touch, more suited to the cultural context and the audience for which this visual repertoire was designed, while simultaneously respecting al-Sufi's iconographical structure. The Ludwig XII.7 manuscript, nowadays preserved at the Getty Museum, a scientific miscellany provably made in Oxford in the last quarter of the 14th century, has a direct relationship with the Alfonsine production. One of its parts seems to be inspired by a fragment of the *Libro de las estrellas fixas*, the first treatise of the *Libro del saber de astrología*, keeping the same iconographical features than the Alfonsine manuscript, documenting the circulation and preservation of the visual culture of Alfonsine astronomy in other territories and chronologies.

Physical Sciences | Europe | Medieval

The World Economy as Scientific Object, 1930-1939

Max Ehrenfreund
Harvard University

The mathematical model of the U.S. business cycle that Jan Tinbergen and other economists employed by

the League of Nations developed from 1936 to 1938 was arguably the first scientific representation of a national economy. This paper examines the relationship between this seminal model and diplomatic and ideological disputes that pervaded daily life for researchers at the League. Tinbergen's methodology was a formal analogue of internationalism, the League's predominant political philosophy. Internationalists assumed that the true character of phenomena was independent of specific national or cultural contexts, and that science could therefore be a force for unity and peace. Likewise, Tinbergen mathematically distinguished societal, cultural, or other so-called "structural" factors that might vary with time and place from the fluctuations of an abstract, idealized business cycle. Describing and predicting these fluctuations, he argued, was the purpose of the new science of econometrics. His methods satisfied the requirements of the League's permanent staff, who sought to avoid the constant strategic conflicts among diplomats in Geneva by presenting scientific knowledge as disassociated from any one national point of view. Tinbergen's work was an early

example of how, later in the 20th century, certain claims about the character of economic life would enable economists employed by governmental agencies to present their advice as neutral and technical. The idea of the economy as an object of scientific investigation, predictable and universally accessible to researchers and observers regardless of their political allegiances, originated in part as a response to the intrigues of the League.

Social Sciences | Europe | 20th century, early |
Statistics, economics, business cycle, Jan
Tinbergen, quantification

The World in One Recipe? Noël Vallant (1632–1685) and Non-European Remedies in Seventeenth-Century Paris

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Institut historique allemand Paris

Examining the recipes of Noël Vallant (1632–1685), private physician of Parisian nobility, this paper focuses on non-European substances used in medical therapies in seventeenth-century France. The question of what happened to ‘exotic’ remedies entering the European market has been previously neglected. The example of Vallant, who was well-positioned to access and prescribe newly

arriving drugs of all kinds, promises particularly valuable insights into how an early modern French physician approached these substances and sought to employ them. I will open with a brief overview of the seventeenth-century Parisian medical marketplace, followed by an illustration of Vallant’s strategies in acquiring non-European remedies and associated knowledge and an analysis of his recipes, where non-European and European substances met and interacted. These cross-cultural encounters reveal that imported remedies like clove, ginger, or turmeric were not uncommon among the Parisian nobility around 1650 and became frequently entangled with magic or traditional European therapies in processes which produced novel forms of therapy.

Thematic Approaches to the Study of Science |
Europe | Cultural and cross-cultural contexts,
including colonialism in general

Theory and Practice of Eclipse Computations by John of Genoa in the 1330s

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CNRS SYRTE

Before 1332 in Paris, John of Genoa elaborated an original table of Lunar and Solar hourly velocities combined with a table of the radii of

the Sun, the Moon and the shadow of the earth, including a column for the variation of the shadow of the earth – *variatio umbre* – used as a function of the motion in anomaly. This table was probably composed for renewing two tables embedded in John of Lingères's set of tables (1321). It is the starting point of a whole project focused on eclipse theories and calculations. Indeed, John of Genoa wrote a canon associated with his table, and then eclipse canons entitled *Canones eclipsium* (1332). The climax of his work was a thorough computation of the solar eclipse of the 3rd March 1337. It is the most detailed calculation of the late Middle Ages. Three manuscripts contained this work, which is an important witness for the history of calculation practices. In this paper, I will compare the calculation provided for the 3rd March 1337 with the methods for establishing a calculation of eclipse that John of Genoa described in his *Canones eclipsium*. With this analysis, I will consider the link between theoretical knowledge and a real practice of computation.

Physical Sciences | Europe | Medieval | Eclipse

Thinking in Averages: On the Conceptualization of the Level of the Sea as a Mean

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Science

In recent decades mean sea level has become the almost unavoidable reference point of an impending environmental cataclysm. Before that it had been naturalized as the most common, almost intuitive vertical datum. The idea to neatly conceptualize the vertical boundary between land and sea as an average is however a fairly recent one. By all its allure as a global baseline it is also the product of very specific local environmental and cultural conditions. As such it is the outcome of a process of social construction that begun in the early modern period in two very specific, quite muddy regions of Europe: Venice and the Netherlands. In this paper I explore how and why the idea to measure the level of the sea first developed where and when it did, discussing extensively the geographical constraints of its conceptualization. Furthermore I relate how the level of the sea was, around the turn of 1800, rethought as an abstract, averaged version of the different levels that can be

physically apprehended along coasts and littorals. I proceed, in other words, in the analysis of a crucial case study in how local measurements were morphed into standardized, discrete, and more legible features to then become global in the wake of Europe's imperial and colonial ventures.

Earth and Environmental Sciences | Europe | 18th century | abstraction, sea level, globalization

Thinking Small: Infinitesimal Thought in Early Modernity

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As is well known in the history of mathematics, the path to the invention of calculus in late seventeenth-century Europe passed through Buonaventura Cavalieri's geometry of "indivisibles," the infinitesimally small slices into which he proposed dividing geometric figures in order to compute the total area contained within their boundaries. The ontological status of these indivisibles was, however, a vexed issue, and the problem of how to deal with the infinitely small would remain a source of much contention for centuries -- as is suggested by Bishop Berkeley's withering

description of Newtonian "fluxions" as the "ghosts of departed quantities." Tracing the path from Cavalieri's indivisibles through Leibniz's infinitesimals, my paper will suggest that early modern attempts to render calculable the minutiae of space and motion have a wide cultural resonance, one that becomes especially visible in literary and metaphysical experimentations with sequences and progressions, in such diverse writers as Gaspara da Stampa, Shakespeare, and Milton.

Mathematics | Europe | Renaissance | limits, differentials

Time, Sense Perception, and Experiential Knowledge in John of Saxony's Epochs of Nations

Nicholas Jacobson
CNRS SYRTE

During the late fourteenth and early fifteenth centuries, the calculating techniques described by the canons found in the Alfonsine Tables became a topic of general epistemological interest at the University of Paris and other major centers of learning in Latin Europe. Scholars and ecclesiastical administrators, such as Nicole Oresme (d. 1382), Pierre d'Ailly (d. 1420), and Nicholas Cusanus (d. 1464) correlated these iterative and

approximating methods of calculation with practical modes of knowing, which they associated with a distinct realm of human experience and political action. Drawing on Aristotelian natural philosophy, these scholars often questioned the reliability of the data established in the tables for being based on conjecture and the particularities of sense perception rather than the exact, invariable principles necessary to establish universally accurate predictions. In this paper, I argue that the early Parisian astronomers who shaped the Alfonsine Tables in the 1320s may have already been aware of these epistemological judgments, and sought to mitigate such criticisms in their canons with recourse to Aristotelian definitions themselves. We see this particularly in the first two propositions of John of Saxony's 1327 canons, which provided instructions for converting epochs of different nations contained in the tables. In these propositions, John of Saxony cited Aristotle's treatment of the commensurability of time and physical motion, the infinite divisibility of continua, and the importance of observational experience in order to establish the

certainty and convertibility of different epochal radices.

Physical Sciences | Europe | Medieval

Too Many Cook(books) Spoil the Broth: Handbooks as Objects of Disciplinary Division

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Handbooks and manuals are where the knowledge and practices of a discipline accumulate. In their use, professional standards can be disseminated and enforced. But even in their rejection handbooks be used to construct disciplinary boundaries. This paper offers a historical example documenting the tenuousness of a manual's authority and role as an instrument of professionalization. In the early twentieth century, disciplinary boundaries were being created within the larger field of industrial chemistry. Denouncing the use of manuals, pejoratively termed "cook books," helped to solidify professional prestige among individual or groups of industrial chemists through the exclusion of chemical technicians, in part along gendered lines. The rejection of "cook books" for use in research or industry soon extended into a rejection of their use for education.

Although handbooks are no longer an object of common contention among scientists, the term “cook book laboratory” has lasted to the present day among science education reformers.

Physical Sciences | Global or Multilocational |
20th century, late

Total Knowledge in Teutonic Tomes? Encyclopedic Handbooks in the Chemical Sciences, ca. 1930-1960

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The question of how the pre-digital modern sciences have coped with knowledge inflation is as open as timely. Handbooks, understood as heavy, multivolume reference works claiming to present a discipline’s essential knowledge in a systematic order, were an innovation to deal with this problem, which flourished particularly in Germanophone science. The tomes of such scientific encyclopediae were consulted for reference, and often became canonical. This paper contours the “Handbuchwissenschaft” (Fleck) as an ensemble of specific actors and practices by scrutinizing the making of a central reference work on inorganic chemical substances, “Gmelins Handbuch der

anorganischen Chemie” (8th edition, >700 volumes). How did the hundreds of involved “paper scientists” and clerks extract and compile knowledge deemed reliable? How was the editing of this megalomaniac book organized by a state institute in the rapidly changing linguistic and technological environment of the post-war decades? While the concept of book informing Gmelin and other Germanophone handbooks was framed in a holistic discourse on knowledge, the rapid increase of journal articles subverted this concept, leading to a crisis of the project after 1960. Looking at the handbook as a past solution to knowledge inflation does not only permit to re-evaluate the role of books among the modern sciences’ media, it may also be informative for the history of our own discipline, since Gmelin and other handbook projects contributed to historiography e.g. by collecting or editing sources.

Aspects of Scientific Practice/Organization |
Europe | 20th century, late | book, chemistry,
classification, Germany, media

Traces of the Plant World: How to Read Botanical Prose

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Throughout the 16th century the most influential scholars of the time as well as interested laypeople started collecting, sending, and amassing immense herbaria of plant specimens. In this way, plant specimens gradually gained importance and meaning, being increasingly perceived by naturalists as equivalent to quotations and paper slips. Eventually, herbaria transformed into printed publications, which in turn had to be read in a certain way. As the student of medicine and Italian poet Christoforo Paganelli wrote in one of his dedicatory poems for Andrea Cesalpino's *De plantis* (1583): "...whether picking up (legens) a fruit of the greening garden, or herbs, or pleasantly smelling little flowers, you want nothing less than to leave." Keeping in mind the different semantic meanings of *legere*—picking-up, reading, collecting—introduces an analogy of reading the book like one reads fruits, herbs, and flowers in the garden, thus bearing interesting implications for the readership. In my talk I contrast the very conscious

reflections on texts, books, natural things and related practices discussed in the paratexts of Andrea Cesalpino's *De plantis* and Pier Andrea Mattioli's *Commentarii* (first edition 1550 in Italian) with my findings of inserted natural things and their traces in some remaining copies of these works. This gives us new insights into how readers perceived those two quite different works and their positions on debates over how to write botanical prose as well as into how natural things, their traces, and their textual-visual representations in the printed books interacted with one another.

Thematic Approaches to the Study of Science | Europe | Renaissance | collecting, herbaria, herbals, traces, objects, plants, texts

Tracing Racial Illustrations in Historic Cranial Collections, 1790-1850: Camper, Blumenbach, and Morton

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In comparative racial craniology, the foundation of physical anthropology, authoritative knowledge about racialized bodily difference was produced through intertwined projects of quantifying and visualizing cranial morphology. While craniological quantification

has received significant critical attention, visualization has received comparatively less. However, the woodcuts, engravings, and lithographs portraying “racial” skulls prior to the common use of photography in the 1880s were essential in defining and disseminating typological racial templates. Here, I focus on the human cranial collections of Petrus Camper (1722-1799) in Groningen, the Netherlands, of Johann Friedrich Blumenbach (1752-1840) in Göttingen, Germany, and of Samuel George Morton (1799-1852) in Philadelphia, U.S.A., and their associated publications. These three were arguably the most influential craniologists prior to 1850. Comparison of their works is instructive, as each explicitly attempted to improve upon prior methods of visualization, each used different methods for composing illustrations, and each claimed to accurately depict skulls. Comparisons possible by analyzing metrically precise 3D digital models of skulls depicted in these illustrations against the illustrations themselves reveal dramatically different visual practices in an apparently similar genre of craniological atlas. Remarkably, the

most “mechanically objective” illustrations were Camper’s, which were chronologically the first. Blumenbach’s illustrations display an idealized, Romantic aesthetic, while Morton’s illustrations are so metrically distorted he could not have produced them with the device he claimed to have used. Taking the materiality of cranial collections seriously as an historical archive can disclose heretofore obscured distortions and transformations in the scientific construction of bodily difference.

Biology | Europe | 19th century | craniology, race, material culture, visualization, representation, scientific images, aesthetics, measurement, anthropology

Tracing the Zigzags of Early Anthropology

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“Beauty is truth, truth beauty,” or so said Keats. Historians of science are very adept at understanding the complexities involved in translating natural phenomena into fact, and fact into truth. Less critical attention, however, has been paid to beauty and how it has shaped expectations of what the truth looks like. How have aesthetic judgments of beauty, shaped by the senses, contributed to the construction of knowledge in the

human sciences? In this talk, I explore anthropological efforts to understand art-making in the late nineteenth century. In particular, I examine biological attempts to explain the evolution of ornament, conducted by an array of zoologists and anthropologists between 1870 and 1900, which applied the analytic tools of embryology and morphology to the products of human craft. As a result, simple geometric patterns like the zigzag were understood to be the most primitive. These analyses were based on western aesthetic judgments of beauty, and characterized the art of non-western peoples as degenerate and unsophisticated. Through this study, I show how scientists relied on their own aesthetic sense while denying taste to the people they studied. Applying a biological frame to the problems of culture assumed that non-western peoples were only capable of replication, thereby denying artistic sensibility and creativity to Indigenous makers. In doing so, anthropology translated taste into scientific knowledge of human difference. Truth could

indeed be built upon beauty, but only the right kind of beauty.

Aspects of Scientific Practice/Organization |
Global or Multilocational | 19th century

Tracing Things and Knowledge in the *Historia Medicinal* (1569-74) by Nicolás de Monardes

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University of Regensburg

The *Historia medicinal de las cosas que se traen de nuestras Indias occidentales* written by the Spanish naturalist and physician Nicolás de Monardes was published in three parts in the 1560s and '70s. The book dealt mainly with medical products from the New World and was widely distributed throughout Europe and the Spanish Empire. Its success was partly due to the author's way of gathering information and eyewitness reports from the New World. Furthermore, Monardes did not write in Latin, but in his native Spanish, was open-minded towards the medical use of exotic plants, and experimented with different herbs and remedies like other contemporary authors. The success of the first publication brought him many new informants. Their reports and testimonies served as the basis for the second and third parts of the *Historia medicinal*. The

paper explores the question of how things—medicine, drugs, and other natural products—found their way from the East and West Indies to Europe and what kind of knowledge travelled with them. It asks how knowledge about products with medical uses was produced in the New World with the help of indigenous informants and other local actors and how this knowledge was mediated and transmitted by naturalists such as Monardes who maintained a correspondence network with Spanish colonizers and European scholars alike. Thus, the paper contributes to further understanding of the material entanglements between the New World and Europe in the early modern era and the traces thereof in texts, images, and objects.

Medicine and Health | Global or Multilocal | Renaissance | information and data collecting, New Spain, global history, natural history

Training Physicists and Historians in Mid-Nineteenth-Century Berlin: Exercises and Epistemic Virtues

Sjang Ten Hagen
University of Amsterdam

A parallel development in the history of the sciences and the humanities was the structural organization of small-scale,

practical, and method-oriented training by German university professors in the mid-nineteenth century. For several disciplines in the humanities and the sciences, historical studies exist which deal with the details of such training. So far, however, the results of these studies have hardly been brought into relation with one another. In my paper, I compare the pedagogical methods of physicists and historians in mid-nineteenth-century Berlin. My main focus lies on the schools emerging around the physicist Heinrich Gustav Magnus and the historian Leopold von Ranke. Remarkably, the most advanced exercises (Übungen) that they organized did not take place at the university, but at their private homes. In family-like settings, Magnus and Ranke developed a personal bond with their students, and established standards for the methods and scholarly persona necessary to obtain legitimate “scientific” (wissenschaftliches) knowledge. Drawing the comparison further, I argue that some of the epistemic virtues stressed by historians and physicists trained in these environments were strikingly similar. For instance, Magnus, Ranke, and their students (including

Hermann von Helmholtz and Heinrich von Sybel) were all concerned about the proper relation between empirical and speculative methods. While defining this relation, they commonly referred to the importance of ‘exactitude’, ‘skill to combine’ (Kombinationsgabe), and ‘objectivity’, even though the interpretations and practices they associated with these epistemic virtues were different.^{[1][2][3]}

Tools for Historians of Science | Europe | 19th century

Transgressions and Regressions: An Incomplete Atlas of Stones

Elise Hunchuck
Independent Researcher

In Japanese traditions there is continuity between nature and culture in so far as the sense of a place speaks directly to the intricate interplay between human and natural forces. This continuity is most clear in the historical practice of naming *utamakura*—storied places shared through literature and art, imbued with geologic history, human history, and cultural meaning. Since the 869 tsunami along the Sanriku coast of northern Japan, communities erected stone tables which perform a dual function; they

are warnings—markers of the edges of inundation, they indicate where to build and where to flee when oceans rise; and, they are memorials, erected as part of a ritual that memorializes events and those lost. These markers make manifest geologic forces from past and certain events of the future. Now surveyed and mapped, this network of historical environmental data at the scale of 1:1 along the coast of Japan is legible elsewhere. These tablets—technologies of linear marks in stone—have a pressing relevance that is too important to be simply a marker of a past event or a memorial to lives lost. These tablets—each like *utamakura*—are part of a multivalent knowledge exchange through time and space, and with hundreds of tsunami stones planned in the coming years to commemorate the 2011 tsunami, and as Japan continues to build almost 14,000 kilometres of seawalls, they are critical in establishing an understanding that the crisis facing coastal landscapes is an ongoing project, not limited to the aftermath of emergency.

Earth and Environmental Sciences | East Asia |
Longue Durée | tsunami, memory, danger

Translating Metrology

Florence Hsia

University of Wisconsin-Madison

For early modern European savants, metrology was a major conceptual and practical crossroads, where antiquarian inquiries into the patriarchs' cubit and the Roman foot met with urgent contemporary matters of commercial and scientific exchange. Translating unfamiliar but newly relevant Chinese vocabularies of measure, number, and weight proved an irresistible challenge. The Leiden professor of mathematics and Arabic, Jacob Golius (1596–1667); the Bodleian Keeper, Thomas Hyde (1636–1703); and the Royal Society's curator of experiments, Gresham Professor of Geometry, and city surveyor, Robert Hooke (1635–1703), were among the most influential scholars to try their hand at translating Chinese numerical and metrological expressions. While these efforts to establish a vocabulary fundamental to scientific translation exhibit a wide variety of investigatory methods and distinct networks of citation and collaboration, the working assumptions at issue suggest an emerging set of norms for

'sinological' knowledge transfer avant la lettre.

Aspects of Scientific Practice/Organization | Global or Multilocational | 17th century | translation, metrology, numerical expressions, commercial practices, learned societies

Translating Science: Sayyid Ahmad Khan's Scientific Discourse in Print

Sarah Qidwai

University of Toronto

In 1848, Sayyid Ahmad Khan (1817-1898) published an article in which he defended the theory of a motionless Earth. By 1865, he had changed his position and argued that the Earth did revolve around the sun. Curiously enough, his defense of this idea is presented in his bilingual publication *The Muhammadan Commentary on The Holy Bible* (1865). As a historical figure, Sayyid Ahmad is frequently characterized as a forefather of Muslim nationalism in India and a reformer of both Islam and education. Throughout his life, he established several educational institutions, publications and societies. Most famous is the Muhammadan Anglo-Oriental College, established in 1875, now called Aligarh Muslim University. However, his attempts to popularize science in colonial India are

overlooked. This paper focuses on three distinct areas where Sayyid engaged with scientific discourse in print. Bringing together the fields of the history of science and religion, print culture, and science popularization, I argue that Sayyid Ahmad was not simply translating or transmitting “Western” knowledge. In fact, he was drawing on ideas already present in India alongside new theories in his popularization efforts. The publications include the translations of *The Scientific Society* (est. 1864), *The Commentary on the Bible* and select articles from the journal *Tahzib-ul-Akhlaq* (*A Refinement of Manners*), established in 1870. Of particular interest is the role of translating concepts in Urdu. What terms were used and how were concepts translated or combined? Overall, can we as historians label Sayyid Ahmad a popularizer of science?

Aspects of Scientific Practice/Organization | South Asia | 19th century | Urdu, Islam, Print Culture, Science and Religion

Translating the State: Technical Translation in Building the Russian Empire

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The figure of Tsar Peter I of Russia (1672–1725), a reputed reformer of the early Russian state, has become a plastic signifier and conveys different kinds of historical symbolism. But it is widely agreed that the formidable pace of Petrine reforms caused a genuine struggle to construct such a language of the new Russian technocracy which could serve as an effective instrument for collective actions. The emerging Russian empire was rapidly changing its language of operation and eventually translated itself into a linguistic and governmental structure, many features of which were borrowed from German cultural patterns. This paper will focus on Peter's military shipbuilding, which started from his hands-on training as an apprentice to the VOC shipyard in Amsterdam, and will examine how individual efforts in technical translation eventually contributed to creating a model for an endeavour on an imperial scale. By navigating ships Peter learned how to navigate his

new state, and my paper will trace this development on the level of individual cognitive tasks in translation, the level of translated normative practices which were established in the Russian Navy, and the state level which employed translation for building the legal framework of the state. By reconstructing the practices of this complex endeavour in translation between languages, technologies, and administrative models this paper seeks to clarify how the institutionalized procedures of translation helped reconfigure early modern Muscovy, with far-reaching implications for global history.

Aspects of Scientific Practice/Organization |
Global or Multilocal | 18th century |
translation, practical knowledge, legal history,
imperial policies, technology, navigation,
shipbuilding

Translating, Printing, and Reading the Art of Distillation

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In 1651, John French (1616-1657) offered the English reading public a new handbook: *The Art of Distillation*. The work represents the fruits of French's wide-ranging reading and translating practices and includes large sections (with images)

extracted from Johann Rudolph Glauber's (1604-1670) *Furni novi philosophici*, a series of five German tracts on distilling published in Amsterdam in the 1640s. In the mid-1730s, the Devon-based Tallamy family obtained a copy of *The Art of Distillation*. Led by Rebecca Tallamy, they wrote a cornucopia of annotations into their treasured copy of French's book, including hundreds of additional recipes and personalised selections from other contemporary medical books including the works of Nicholas Culpeper and William Salmon. The printed medical book, then, is at once a conduit and a receptacle for medical knowledge - a personal archive of know-how strategically assembled to suit the needs of the family. Taking this curious volume as a starting point, this talk explores translation, print, and medical reading in early modern England. I examine the intertwined practices of translation, reading and writing as ongoing, collective, and collaborative projects embedded within practices and local contexts, taking meaning both from its creators and its users. By situating the case study within analytical frameworks developed by historians of archives, I also emphasise how

processes of translation, reading and note-taking were all deliberately employed to create an eighteenth-century home-based archive of everyday knowledge.

Medicine and Health | Europe | 17th century

Translation and the Making of a Scientific Archive: The Case of the Islamic “Translation Movement”

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Translation plays a central role in the historiography of Islamic science and medicine. Two episodes of translation bookend the “Golden Age”: the translation from Greek to Arabic, and that from Arabic to Latin. In both processes, translation is understood as a mode of acquisition and/or loss where knowledge moves across a linguistic divide in a process that begins (or ends) a particular historical episode. However, this translation-as-transition paradigm fails to capture the linguistic diversity that existed on both sides of this seeming divide, and the production and consumption of this translated knowledge and its diffusion beyond the spheres of learned scientific and medical practice. Moreover, translation-as-transition paradigm foregrounds the

fixity and “foreignness” of Greek knowledge rendering Islamic sciences derivative and secondary—a science-in-waiting for European Renaissance. In this paper, I look at translation in the history of Islamic medicine not as a transition but rather as a part of a larger and more comprehensive process of archive-making. Through following the works of translators and historians, I investigate how translation contributed to the production of a particular form of learned medicine, and to the making of specific socio-professional identities. I argue that understanding translations as part of the production of knowledge is key to pushing a more accurate, innovative and comprehensive global history of science in the pre-modern world.

Medicine and Health | Near and Middle East | Medieval

Transplanting Technology: Dr. DeBakey in Cold War China and the USSR

Heidi Morefield
Johns Hopkins University / Princeton University

At the height of the Cold War, Dr. Michael E. DeBakey, one of the most prolific American surgeons of the 20th century, made several trips to China and the USSR to survey the

medical landscape on the other side of the Iron Curtain. He toured clinics and medical schools and met with barefoot doctors. DeBakey became a broker of valuable medical and scientific information, teaching new techniques and introducing new machines in the USSR and China, while reporting on the conditions of Chinese and Soviet medical institutions back home to the American public. His diplomatic success was possible in part because of his willingness to take other medical systems seriously—he praised the barefoot doctors and was “impressed” with Russian medical inventions that were showcased during his visits. This paper draws from archival and oral historical material in Dr. DeBakey’s personal papers to consider the ways in which he was able to gain mobility between the Cold War East and West through his expertise in medical technology. With rich diary entries describing his visits, DeBakey situated both the Western technology he helped transplant to the East as well as that which he encountered there within the topography of the Soviet and Chinese medical systems. In reflecting upon DeBakey’s Cold War travels, this paper seeks to

interrogate how his influence and mobility shaped perceptions of both American and communist-sphere medical technology.

Medicine and Health | Global or Multilocational | 20th century, late | History of medicine, Cold War, Michael DeBakey

Travelling Back through Them: Immersion and Virtual Mobility by 17th Century English Scientific Collections

Saara I. M. Penttinen
University of Turku

My presentation investigates two key concepts that both in historical and museological research need more analysis on – virtual travel and immersion – and their relationships with the 17th century English natural history collections, commonly known as cabinets of curiosity. Virtual travel is a concept far older than one would think meaning basically being “as good as” actual travel. Immersion, on the other hand, is a term from modern day research on virtuality, meaning e.g. the feeling of getting “sucked” into the world of a video game. My argument is, that in this era with relatively little information about faraway places, and the lack of more “advanced” technologies for recreational virtual travel, experiencing these early scientific

collections would have been extremely sensual and immersive, to a degree we cannot fully relate to today. The reasons for feeling the need to replace travel were not straightforward, but they shed light on the complicated relationship the premodern people had on travelling, empiricism, and seeing with one's own eyes altogether. Because these collections were in the center of both the scientific (e.g. medicinal), and entertainment cultures of Early Modern Europe, their immersive qualities resulted in the continuous increase in the demand and consumption of exotic objects and products impacting the global networks of trade and science. This presentation is based on my dissertation, which explores themes such as the interplay between materiality, sensory experience, and geographical imagination.

Tools for Historians of Science | Europe | 17th century | cabinets of curiosity, history of collections, collections, virtual travel, virtuality, immersion, mobility, travel, history of travel, scientific collections,

Trespassing Tigresses and "Pig-Headed Celts": Corresponding beyond Class Boundaries, from Scotland to Calcutta

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University of Cambridge

Between 1862 and 1879, 291 letters were exchanged between the most celebrated nineteenth-century naturalist, Charles Darwin (1809-92), and self-taught, working-class gardener, John Scott (1836-80). Scott was a foreman at the Edinburgh Botanical Gardens when he first wrote Darwin to point out an error in *The Fertilisation of Orchids* (1862). Darwinism was controversial in 1860s Edinburgh, particularly at the Gardens. However, Scott infiltrated the Garden's lectures, appropriated their microscopes, and, by virtue of Scott's low social class, could sneak from his bothy on the edge of the gardens into its hothouses on Sundays, to perform observations and experiments. Scott not only provided specimens for Darwin, but, from a garden intended for economic botany, he also engaged in theory. The price for Scott's trespasses was his job. Through Darwin's patronage, Scott became curator of the Calcutta Botanical Gardens. Scott challenged the

borders of spaces physically, temporally, and theoretically inaccessible to a man of his station. His instrument was the letter. Yet correspondence also reveals the limitations to Scott's trespasses. In this paper, I seek to find an analytical bridge between the situatedness and the mobility of Scott and his science. By taking the letter itself as a spatial entity, one co-constructed – quite literally in dialogue – by sender, recipient, and their respective networks, I explore how Scott functioned as a mediator of social and scientific hierarchies. I argue that whilst Scott's status may seem to defy stable definition, it was simply constructed and perceived differently by different correspondents and their respective contexts.

Aspects of Scientific Practice/Organization |
Global or Multilocal | 19th century |
Correspondence, Class, Science and Empire,
Locality, Globality

Trial and Error in Astronomy: Arthur S. Eddington's Stellar Models

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Arthur S. Eddington (1882-1944)
certainly was one of the world's
most famous astronomers during the

interwar period. For thirty years he was the director of the Cambridge Observatory and taught astrophysics at Trinity College. From 1916 onwards, he endeavored to develop a series of stellar models and a decade later he published his influential *Internal Constitution of the Stars* that Henry Norris Russell dared call “a work of art”. Besides the different steps that led Eddington to his famous mass-luminosity relationship in 1924, enlightened by some unpublished correspondence, this paper addresses some original views in terms of methodology. Indeed, Eddington purposely used trial and error, which he considered “as scientific as any other method”, the important point being to obtain physical insight on the problem one intends to tackle, and to keep mathematics “as the tool and not the master in physical research”.

Physical Sciences | Europe | 20th century, early
| astrophysics

True Solar Motion, Eccentric Parameters, and Clocks as Mathematical Instruments: Tracking Planetary Theory within the Gears of Renaissance Automata

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Planetary automata, also called planetary clocks, were expensive and rare masterpieces of technical ingenuity designed to show the subtle motion of the heavenly bodies according to Ptolemaic theory. These automata may justly be considered mathematical instruments for a two-fold reason: they manifest a mechanical transposition of mathematical astronomy, and their conception and design required the mastery of practical geometry and trigonometry. They were almost exclusively the reserve of princes and emperors, and within the history of astronomy notice of about a dozen of them has reached us, of which four from the Renaissance survive (in Paris, Vienna, Kassel, and Dresden). This paper presents new research on these instruments, focusing on the two created under the explicit direction of Landgrave Wilhelm IV of Hesse-Kassel around 1560. Passing from the abstract

geometrical models described by Ptolemy to a brass mechanism led Wilhelm, his chief “artifex” Eberhard Baldewein, and the roughly dozen craftsmen working under them to use eccentric axles, epicyclic gears, and cogwheels with deliberately uneven tothing. The research described, part of the ongoing project “Deus ex machina,” aims at deducing certain astronomical parameters implicit in Wilhelm’s mechanisms. In particular, the possibility of deriving parameters for the solar eccentricity will be explored in connection with Wilhelm’s own renowned program of astronomical observation. Could it be that a careful analysis of these machines (and the written sources once accompanying them) allows us to witness in their gearing the birth of a new astronomical theory?

Mathematics

Tuning the Workplace: The Herman Miller Research Corporation and the Architectonics of Information

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In the 1960s and 70s, architects and designers looked to the sciences for inspiration and a systematic

approach to shaping environments rich in information. This is particularly evident in an approach promoted by the Herman Miller Research Corporation (HMRC), a division of the iconic furniture manufacturer. In 1968, HMRC launched an influential open-office management concept called Action Office. Promising to adapt the workplace to a new era of “knowledge workers” and invoking concepts in management, human sciences and engineering, its developers claimed to tackle problems of information overload, declining productivity and employee satisfaction. Within a decade, the concept got implemented in hundreds of corporate, governmental and public service offices and research laboratories. Focusing on the period 1959 to 1976, this paper catalogues and analyses the firm’s efforts to study, rationalize and measure white-collar creativity and productivity, and in so doing legitimate a discursive and material re-arrangement of the office. In particular, it shows how HMRC researchers drew together concepts and methodological approaches from emerging subdisciplines such as ergonomics, proxemics, environmental psychology and

psychoacoustics to develop an embodied model of information processing and recalibrate workers’ comfort, creativity, and exposure to information stimuli—on paper as much as in their social, visual and acoustic surroundings. This paper explores how their efforts to shape and validate such effects on white-collar work contributed to broader transformations in notions of information and productivity, and produced a template, both for a particular approach to corporate research and for future imaginations of the workspace.

Aspects of Scientific Practice/Organization | North America | 20th century, late | office, productivity, information, corporate research, design

Turning Meteorological Data into Climate Science: Maps, Diagrams and Formulas in Germany, 1871-1914

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Around 1900, Germany housed several large commercial firms for map making, such as Justus Perthes in Gotha and Velhagen & Klasing in Leipzig. The first especially had a large impact on academic climatography through its scientific flagship journal *Petermanns*

Geographische Mitteilungen. This, together with the daily weather maps produced by the climatographer Wladimir Köppen at the Deutsche Seewarte from 1876, gave scientific map making in the German climate sciences an academic prestige never before possessed, even in the time of Humboldt. According to Nils Güttler, the mass-produced maps of the late nineteenth century produced new scientific principles and gave scientists and their audiences a seemingly objective *Totaleindruck* that data and thick description were not able to give. In the early twentieth century, however, meteorology and climatology developed into dynamical sciences thanks to the new practice of aerology, the more-than-daily collection of atmospheric data from weather balloons at different heights. Climatological maps increasingly had to compete with other forms of representation, especially mathematical formulas and diagrams. How should one represent altitude or development over time? Techniques had developed to add more than latitude and longitude on maps, such as isolines, colors, and arrows, but sometimes formulas and altitude diagrams were better in giving a

Totaleindruck. I will examine the different strategies of climatological data representation by German aerologists such as Wladimir Köppen and Alfred Wegener and the Norwegian Vilhelm Bjerknes who taught in Germany, to show that ultimately maps had advantages over diagrams and especially formulas: a larger audience.

Thematic Approaches to the Study of Science | Europe | 20th century, early | aerology, climate maps

Tycho Brahe and the Inquisition in Iberia

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It is known that throughout the seventeenth century the world system proposed by Tycho Brahe (1546-1601) assumed a preponderant position in the Iberian cosmological debate, affirming itself as the one with the best agreement to empirical evidence. Moreover, the Tychonian model (or variants thereof) did not present the difficulties of apparent contradiction with the scriptures, as the heliocentric proposal of Nicolaus Copernicus (1473-1543) did, since it kept the earth fixed at the centre of the world. However, Tycho as a

Lutheran author was targeted by the Inquisition. Passages of various works of the Danish astronomer were included in the Spanish indexes of 1632, 1640 and 1707, although the formal condemnation of the Roman Inquisition never materialized. In the network of the Society of Jesus a seemingly informal censorship also circulated, apparently based on Tridentine determinations, published in 1651 in the influential work of Giambattista Riccioli (1598-1671) *Almagestum novum*. I will discuss the scope, effects and limitations of the censorship of Tycho's scientific books in Portugal and Spain, through the analysis of several annotated copies, preserved mainly in Iberian libraries, with a special attention to books from ancient Jesuit colleges.

Physical Sciences | Europe | 17th century | astronomy, cosmology, Inquisition, book censorship, Iberia

Unresolved Conflicts about Sex: Julian Huxley and the Progress of Sexology in Britain, 1916-1930

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Oxford Brookes University

This paper recovers a significant body of Julian Huxley's early writings concerning the biology of

sex determination, sex development and sexual behavior. Following the success of his studies relating to avian courtship, Huxley envisaged a more integrated approach to the study of animal behavior which would synthesize the perspectives of both field observations and experimental zoology. In this endeavor he considered sex-related questions the most pressing, although, in practice, he failed to assimilate his own ornithological observations of avian courtship with the new biology of sex determination that was developing at a rapid pace in Germany and North America. Huxley learned the latest theories of sex determination directly from Richard Goldschmidt and Thomas Hunt Morgan, largely siding with Goldschmidt's controversial (and ill-fated) 'theory of balance' which catered for a high degree of sexual variation in morphology and behavior.

Especially during his period as Fellow of New College and Senior Demonstrator in the Department of Zoology and Comparative Anatomy at Oxford (1919-1925), the biology of sex constituted one of Huxley's leading interests and played a major role in establishing him as one of the twentieth-century's most famous

public intellectuals and popularizers of science and eugenics. It was largely because of Huxley that, after decades of resisting Continental sexology, the medico-scientific study of sex became both respectable and popular in Britain, although the subject remained inextricably entangled with Huxley's eugenic vision of human progress.

Biology | Europe | 20th century, early | Britain, History of Biology, Julian Huxley, Science Popularization, Sexology, Twentieth-Century

Using Euclid in a Practical Context: Claude Richard's Course on Sectors at the Imperial College (Madrid, ca. 1656)

Elena Ausejo
University of Zaragoza (Spain)

Father Claude Richard (Ornans 1589 – Madrid 1664) was professor of mathematics at the Jesuit Imperial College in Madrid (1627-1767) from 1630 until his death. He published *Euclides elementorum geometricorum libros tredecim Isidorum et Hypsidem et Recentiores de Corporibus Regularibus, et Procli propositiones geometricas* (Antwerp, 1645), and *Apollonii Pergaei Conicorum libri IV cum commentariis Claudii Richardi* (Antwerp, 1655).

Furthermore, the Spanish Royal Academy of History keeps a legacy of eleven manuscript files –titled *Mathesis varia*– by Richard, together with eighty factitious volumes containing Jesuits' manuscripts on mathematics and physics. Among these, two draft copies of the course on the construction and use of sectors taught by Richard around 1656 have been identified, one written by Richard himself, the other by one of his students. Richard claimed that the whole practical geometry consisted of the brief and easy use of sectors, an instrument first invented by the Flemish Michel Coignet, he said. However, his “Treatise on the division of the twelve diverse straight lines of sectors, with their practical use in practical geometry, and also the proofs of these divisions and the use” was not only concerned with the brief and easy instrumental practice of geometry. It also insisted on demonstrating the solid Euclidean foundations of this practice, which would justify the numerical consideration of continuous magnitudes as quantities –accepting a margin of error sensorially imperceptible and

irrelevant for the purposes of application.

Mathematics | Europe | 17th century | Spain, Jesuits, Euclid, Apollonius, mathematical instruments, Coignet, sector

Ventilation, Fumigation, and the Creation of Healthy Air in British Naval Hospitals ca. 1775-1815

Erin Spinney

In response to a request by the Navy's Sick and Hurt Board to investigate the recent sickly state of HMS Foudroyant in March 1804, Plymouth Hospital Governor Richard Creyke summarised the best available advice for creating a healthy environment on board ship: "We strongly recommended Whitewashing, the washing of the people's clothes, Blankets &c, in warm water and Soap, fumigation with Charcoal and Brimstone, to be generally and frequently used, and the Decks to be kept as dry as possible." Creyke was familiar with supervising these same measures in Plymouth's hospital wards. The creation, and where possible the maintenance, of what late eighteenth-century medical practitioners and naval administrators conceived of as healthy air was a primary concern of the clinical naval hospitals of Plymouth and Haslar the sole

purpose of which was to cure and return sick and injured sailors to their ships as quickly as possible. This paper will discuss the means through which healthy air was created including architectural designs, ventilation, fumigation lamps, and cleanliness. I will also highlight the role of female hospital workers in the creation of healing environments. This included female nurses in the cleaning and fumigation of ward spaces and the shifting of wards (intense cleaning and fumigation process carried out in empty wards) in preparation to receive new patients, as well as washer women responsible for the cleanliness of bedding and hospital dress.

Medicine and Health | Europe | 18th century | Medicine, Fumigation, Gender, Reform

Vigyan, Scientific Readerships, and the Colonial Lives of Science Popularization in North India, ca. 1915

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This paper brings together histories of science, print, nationalism and empire through the case study of a popular science monthly established by Indian intellectuals in early twentieth century north India. In

April 1915, a new monthly called *Vigyan* appeared in the Hindi public sphere. It was brought out by a voluntary society, the *Vigyan Parishad*, which had been established in 1913 in Allahabad to spread scientific knowledge among Hindi readers through the production, translation, and publication of scientific works. *Vigyan* was advertised as the ‘one and only illustrated scientific monthly journal in Hindi’, and carried articles on both technical and popular subjects as diverse as magnetism, evolution, electricity, as well as the need for science education in Hindi. This paper focuses on *Vigyan* to bring to light an important historical source for the production and circulation of scientific knowledge in print which has been equally ignored by literary historians and historians of science of South Asia. It engages with the self-description of the monthly as a ‘science periodical’ and ‘science’ in the periodical as an actors’ category to raise questions about the nature of the journal and the knowledge contained and presented within its pages. Finally, the paper reflects on the historical significance of “popularisation” in a multilingual colonial context, marked by

hierarchies of knowledge, power, as well as languages; especially in an era of anticolonial nationalism and linguistic mobilization, when calls to serve the language, nation, and science were often deeply entangled.

Aspects of Scientific Practice/Organization | South Asia | 20th century, early | scientific publication; readers; reception; popularization; public sphere

Visualizing Emotions and the Emotional Economy of Science

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The study of emotions attracted renewed interest in the nineteenth century. Following Duchenne de Boulogne’s *Mécanisme de la Physionomie Humaine* (1862) and Darwin’s *The Expression of the Emotions in Man and Animals* (1872), physiologists, psychologists and neurologists turned to photography and other visualization technologies to understand the correlation between emotions, facial expressions and muscular and nervous movements. Studies by Charcot and others such as the psychologist Georges Dumas and the physiologist Charles Émile François-Franck employed different photographic technologies, from stereography to chronophotography, to produce visual observations of

emotional expressions. These experiments, often performed on asylum patients, sought to identify normal and pathological expressions of emotions. Through the analysis of prints, albums and other photographic material, this presentation will examine the emotional economy of science underpinning medical studies on emotions. In particular, it will focus on the parallels between emotions considered as normal and pathological in scientific studies, and the emotional style at the time. From this perspective, pathological emotions were not only medically but also socially and culturally abnormal. Researchers and photographers, therefore, were invested in obtaining successful experimental results which mirrored and supported with scientific evidence their own emotional regime. Photographic visualisations played a key role in this process, working both as scientific evidence of the physiological nature of emotions and cultural objects that identified normal and abnormal subjects according to the emotions they expressed.

Thematic Approaches to the Study of Science | Europe | 19th century | Images, emotions, research objects, photography, pathology

War and Insect Control in Russia / Soviet Union, 1900-1940

Marin Coudreau

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The Bolsheviks seized power during the Great War and built their dictatorship through a “continuum of crisis” (Holquist), channeling the violence of total war inward. The forced collectivization of agriculture, an unprecedented and cataclysmic experiment attempting to “modernize” the countryside in the context of a looming “inevitable war,” would trigger another wave of ruthless state violence against the peasantry. I analyze the overlap of armed conflicts and “natural” disasters in the long sequences of war, revolution, and civil war and through the forced collectivization and its aftermaths. Discursive and action categories, regimes of mobilization, and imaginaries and technologies expanded from the waging of war to the management of nature. The porosity between war and natural disasters remained starkest in the margins of the Imperial/Soviet territory. Environmental and rebel threats came to be interrelated in the peripheries, where “militarized”

practices of pest control and successive “disinhibiting” (Fressoz) toxic experimentations were adopted in emulation with European colonial practices. The Stalinist “revolution from above” worked as an incubator of the military-scientific experiments and practices of the 1920s.

Biology | Central Asia | 20th century, early |
Entomology, war, Soviet Union

Wet Knees and Cuckoo Holes: On the Materiality of Knowledge in the Dutch Dairy Sector

James Babbitt
Mr.

In this paper I use an example from my ethnographic fieldwork on the the Dutch dairy sector to challenge some troubling claims made by those attempting to historicize contemporary capitalism. Or, to put it another way, what can livestock agriculture tell us about post-Fordist forms of capitalism that increasingly rely on information, data, affect, etc., to reproduce themselves and produce value? In *Cognitive Capitalism*, the French economist, Yann Moulier-Boutang writes that knowledge rather than labor power is increasingly becoming the source of value within global capitalism. I do not take issue with this diagnosis,

however, I would like to problematize the assumption that “knowledge-goods” and “information goods” have what Moulier-Boutang calls an “immaterial nature” (2004). In *General Intellects*, Mackenzie Wark, an Australian cultural critic, reminds us to “hang on to the materiality of information-based sciences and technologies” (2017). In my research I bring the materiality of the body (both human and non-human) into an analysis of knowledge based value extraction in an increasingly digitized dairy sector. Specifically, I examine the “caring labor” (Hardt 1999) of bodily and/or haptic practices taught to veterinarians, feed advisors, and other agricultural professionals by a Dutch dairy consultant. These practices cultivate knowledge and information about animal wellbeing and health in order to increase efficiency, milk production, and farm income and profit. Thus, we see profit, knowledge, information, and bodies (both human and cattle) entangled within the agricultural production process.

Technology | Europe | 21st century | Dairy
Science, Knowledge, Multispecies
Entanglement, Caring Labor, Capitalism

Whaling Intelligence: Paper Technologies of U.S.-American Exploration in the Pacific

Felix Lüttge
University of Basel

The United States Exploring Expedition (1838-1842) owed much of its realisation to the advocacy of Jeremiah Reynolds, a former newspaper man and public lecturer. His strongest case for the necessity of Pacific exploration were New England whalers who were said to cruise unexplored parts of the oceans and whose discoveries of uncharted islands were reported in the local press. The document that stood at the core of Reynolds's lobbying for an expedition, however, was a table he had compiled after interviewing whaling captains in the country's principal whaling ports. By presenting the whalers' experience in tabular and synoptic form, Reynolds's table helped forge the frontier figure of the 'intelligent whaler', a mariner who had better geographical knowledge than other seafarers. In my talk, I will discuss the paper technologies that produced the 'intelligent whaler' and investigate how Reynolds's translation of 'whaling intelligence' from news into facts marks the beginning of the intelligent whaler's

long career in U.S.-American debates about expansionism, exploration, and science.

Aspects of Scientific Practice/Organization | North America | 19th century | exploration, paper technologies, tables, whaling

What "Race" Does: Pluralism in Post-WWII Population Genetics

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It has been a matter of debate among historians of science whether "race" disappeared as a category in the biological sciences with the evolutionary synthesis and rise of population genetics. It has become commonplace among philosophers of science to refer to a "race debate" currently underway about the epistemological and ontological status of race as a biological category, especially in genomics. Embedded in these debates is the assumption that there is such a thing that race is, such that the debate might be resolved one way or another. However, if we consider the influential American population geneticists Dobzhansky, Cavalli-Sforza, and Lewontin, whose contributions during the decades following WWII laid theoretical foundations that are important for genomics today, we find a plurality

of race concepts and a range of significances attached to the use of racial designations—not only among the three geneticists but within the writings of each. Given that there is not such a thing that race is, even for population geneticists, what matters is to pay close empirical attention to the disciplinary, historical, and political contexts in which scientists deploy race concepts and racial designations in order to discern not what race is, but what race does.

Biology | North America | 20th century, late |
race, genetics

What Do Maps Map? Finding the Way in Early Nineteenth-Century British Botany

Anne Secord

Darwin Correspondence Project

Early nineteenth-century discoveries of rare and new plants by artisans in the north of England brought learned botanists to this relatively unknown region of Britain. However, travelling to the areas in which particular plants were known to have been found did not ensure that the desire of visiting collectors to see these plants in their native habitats was fulfilled. Not only were there few reliable maps of the wilder northern lands, but also no guarantee that the exact spot of a rare plant

would be easy to find even if a traveling botanist managed to get to the correct locality. Botanists from outside the area were therefore reliant on artisans to act as guides. Historical evidence of this form of social interaction shows that it goes beyond a simple model of the appropriation of local knowledge. Instead, it brings to light different practices for knowing the land and different conceptions of what counted as knowledge of nature. Learned botanists tended to view not only the land but also knowledge itself as a form of mapping: they argued that information as well as the terrain required to be seen as if from a pinnacle in order to produce scientific generalisations. In contrast, artisans had little conception of maps either as geographical or conceptual tools. Instead, the forms of spatial knowledge they cultivated were more like itineraries. In my paper, I will investigate how mapping and maps provided both advantages and limitations in the attainment of botanical knowledge.

Thematic Approaches to the Study of Science |
Europe | 19th century | botany, plants, maps,
artisans

What Is a Normal Face? Karl Pearson's Principal Component Analysis, Facial Recognition Technologies, and Race

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Since the publication of the paper “On lines and planes of closest fit to systems of points in space” by Karl Pearson in 1918 principal component analysis (PCA) has become an important statistical method in multiple research fields from the natural sciences (i.e. archeology, atmospheric sciences, psychology and physical anthropology) where big datasets of observations are collected. In studies of human facial difference, PCA works by producing statistical description of these differences that are later used to support common sense racial distinctions. In doing so, it establishes standards of normality for different races and, by comparing these normal faces, naturalizes racial difference. The present paper explores the influence of Pearson's PCA in the theory and development of applications for face perception and recognition. Therefore, it focuses on three central cases in the development of facial recognition technologies (FRT): (1)

‘Eigenvector’ algorithms developed, among others, by Turk and Pentland (1991), (2) Valentine's (1991) influential “Face Space” theory of face perception, and (3) Recent FRT such as DeepFace from Facebook (2014 to present). As shown by these cases, Pearson's technique has deeply shaped contemporary FRT as PCA guides the way how computer scientists, forensic scientists and psychologists understand human facial difference as well as the perception of these differences. More generally, telling the story of PCA shows why racial categorization remains central in contemporary identification technologies and practices.

Technology | Global or Multilocational | 20th century, late | Statistics, Race, Algorithms, Facial Recognition Technology, Identification

Why the *Traité de l'homme* Was Not Published by Descartes

Harold Cook
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Descartes several times wrote that the aim of his philosophy was to provide an understanding of medicine so as to improve human life. Why, then, did he hold back his full views about the subject? Could they have been dangerous? Descartes composed a manuscript on

human physiology but held it back. Only a few of his closest Dutch friends saw a copy of physiological manuscript of the early 1640s, and they kept it safe from public scrutiny, as he asked. Descartes continued working on the problems in it, making the text a mess that he could hardly read himself, as he told Mersenne in 1648. But a version, based on the manuscript circulated to his friends as edited by Florentius Schuyt, was later published in Latin (1662) as *De homine*; two years later an edition in French appeared, the *Traité de l'Homme*, overseen by Claude Clerselier. The text famously ends abruptly, with no discussion of the human soul. If we read Descartes's own views not as complete in the early 1630s but as evolving from the conversations of his youth - in the years before Galileo's condemnation - the later disputes in Utrecht, and his last work, *Les Passions* (1649), we can see how the agenda was set by materialist Epicureanism. Giving a full account of humanity without the need to explain the immortal soul would indeed have been dangerous; later commentaries in the published editions tried to remove the threat,

but cannot be taken as Descartes's own opinion.

Thematic Approaches to the Study of Science | Europe | 17th century | Cartesian physiology, *Traité de l'Homme*, *De homine*, *Les Passions*, Epicureanism

With "Scrupulous Fidelity" and "Majestic Beauty": The Science and Art of E. L. Trouvelot's Astronomical Drawings (1882)

Lacey Baradel
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Étienne Léopold Trouvelot's portfolio of fifteen large-scale chromolithographic prints, published by Charles Scribner's Sons to accompany Trouvelot's *Astronomical Drawings Manual* (1882), were among the most influential and innovative images of astronomical phenomena produced at the end of the nineteenth century. The works effectively blurred the boundaries between art and science, receiving accolades from both professional artistic and scientific communities as well as attracting a wide public audience. Trouvelot, a French-born, Boston-based artist and amateur-turned-professional scientist, based the prints on sketches of cosmic forms that he made over the course of nearly two decades using high-powered telescopes at Harvard University, the

University of Virginia, and the U.S. Naval Observatory. According to the artist, the 1882 portfolio aimed to present such forms with “scrupulous fidelity and accuracy,” while also conveying to the viewer something of “the majestic beauty and radiance of celestial objects.” Produced during a period in which photography was quickly becoming the dominant medium for astronomical imagery, Trouvelot argued forcefully against the popular assumption that photographic views of celestial phenomena were more objective or of greater scientific value than his graphic—and often quite abstract—representations. Using Trouvelot’s work as a case study, this paper examines the roles that artistic imagination and invention played in shaping scientific knowledge during the late nineteenth century and investigates the limitations that artistic media and technologies of vision imposed on such processes.

Physical Sciences | North America | 19th century | Art, Astronomy, Art History

Women’s Place in Developmental Theory: From Androcentrism to Anti-Feminism

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This talk highlights the relevance of gender in American and European accounts of identity development in the latter half of the twentieth century. Going beyond existing analyses by Carol Gilligan and other relational psychologists, feminist social scientists and writers, who have read dominant theories of individuation as androcentric, I argue that these were based on normative assumptions about women’s selves and capacities. Reconsidering the implications of male-centered perspectives in the social and human sciences changes our understanding of anti-feminism. More than just an extreme opinion, anti-feminist positions structured basic constructions of the self and social order. Not simply implying that Man was the measure of all people, Erik Erikson, Benjamin Spock, Daniel Levinson, and other social and developmental psychologists, practitioners, and psychoanalytic thinkers also exempted women from personal development. Their theories applied to boys and men almost exclusively,

whose growth and self-realization they described. Yet despite their focus on men, these developmental models were primarily directed at women. The formulations and effects of identity theories in social policy as well as public debates about work and the family show that they provided a guideline for wives and mothers, describing as the primary task of women to produce, even embody a “facilitating environment” (Donald Winnicott) for male development. When women challenged these directions, experts responded by barring them from redefining their lives and seeking self-fulfillment outside the home. By arguing that women’s liberation hindered men from releasing their full potential, they used the notion of identity to defend traditional gender roles.

Social Sciences | Global or Multilocational |
20th century, late | gender, developmental
psychology, anti-feminism

Writing, Drawing, and Preaching Geometry in the Early Modern German Mines

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In the sixteenth and seventeenth centuries, mathematical sciences played an increasingly important role in Western societies. Most

historical accounts try to understand how the study of nature came to use mathematical methods and how mathematical concepts and tool became the standard tool for scholars. A more fundamental and yet lesser-known shift happened outside of the scholarly world. Practical mathematics, understood as a set of basic skills in arithmetic and geometry, became ubiquitous in European civic life for officials, engineer and artisans of all kinds. Early modern mines build a perfect case study for this hypothesis, both given their crucial economic importance and since they are considered a crucible of modern technical rationality. I will analyze the growing importance and the public nature of mathematical arts in the German mining states. Scholars observed practitioners and then wrote about *geometria subterranea*. Numerous sketches were drawn to illustrate the surveying methods that were used. Computing schools and teaching contracts attest of a lively and efficient tradition of practical teaching. Even sermons routinely presented to a general audience the essential features and principles of geometric operations. Surveying was a public practice whose geometrical character would lend gravitas and

accuracy to legal decisions. These ubiquitous uses greatly heightened a public recognition of the efficiency of mathematics.

Mathematics | Europe | 17th century | Saxony, practical geometry, surveying, Markscheidekunst, cultural history, mining history

Zoology of Mixing: Discourses of Race and Species in Early Modern Europe

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As the Spanish Empire grew and society stabilized in the sixteenth and seventeenth centuries, European agents transposed both their breeding practices and zoological language to organize proliferating human difference. Amidst the hubris of imagining how breeding could create a more perfect society, Renaissance European husbandmen and patrons had first developed the term “race” to describe animal offspring born on stud farms. In its original Renaissance conception, race was thought to be malleable while gender and sex were fixed. Within the Spanish Empire, power relations concretized emergent racial categories like mestizo, mulatto, and criollo – terms originally used to describe animal mixing. In the late sixteenth and early seventeenth

centuries, naturalists bolstered their convictions that species boundaries were unassailable. This paper shows how race and species were more discursive constructs than material realities by following the ideas’ proliferation in European discourse beyond the Spanish empire. To that end, this paper analyzes an extensive database that traces the movement of the language of race in humans and animals in published and manuscript sources in Italian, Spanish, French, Portuguese, Dutch, German, Latin, and English between 1400 and 1700. I argue that race—originally a fragile category designating the human artifice that shaped one generation at a time—began to designate traits fixed across generations by the early 1600s, rendering a temporary social hierarchy embodied and permanent. This growing belief in the fixity of difference transferred from Spanish society to the emergent field of natural history, where the most exciting research was being done in the Spanish American empire.

Thematic Approaches to the Study of Science | Europe | Renaissance