

Paper and Poster Abstracts for History of Science Society Meeting – 2014

Abstracts are sorted by the last name of the primary author.

Author: Fredrik Albritton Jonsson

Title: Coal Futures 1789-1884

Abstract: Long before William Stanley Jevons' *The Coal Question* (1865), mining engineers and natural historians sought to calculate the extent of the British coal reserves. Centennial and millennial time scales entered Victorian politics in the 1830s through debates on coal exhaustion. Coal husbandry was theorized by geologists and political economists as a problem of intergenerational equity and became the subject of policy in the case of coal tariffs. After 1870, John Ruskin developed a vision of adverse anthropogenic climate change, linked to deforestation, agriculture, glacial contraction, and coal use. In short, politicians, intellectuals, and scientists increasingly began to see industrial Britain as a carbon society, subject to unprecedented environmental pressures.

Author: Janet Abbate

Title: From Handmaiden to “Proper Intellectual Discipline”: Computer Science, the NSF, and the Status of Applied Science in 1960s America

Abstract: From the mid-1950s to 1970, relations between academic computer scientists and the National Science Foundation underwent a significant shift. Initially regarded by NSF as merely a tool to support the more established sciences, computer science rapidly became institutionalized in university departments and degree programs in the early 1960s, and NSF responded by creating an Office of Computing Activities in 1967 to fund research and education as well as facilities. Since funding is essential to the practice of science as well as a signifier of disciplinary power and status, acquiring a dedicated government funding stream was a remarkable coup for such a young field. Yet both the notion of CS as “science” and the appropriateness of NSF supporting “applied science” were highly contested in contemporary reports, editorials, and congressional testimony, revealing fundamental disagreements over the nature and purpose of science. Within the CS community, the professional society ACM (which attempted to represent the field as a whole) struggled to defuse tensions between academic and industry members with competing visions of their discipline. Within NSF, the question of how to fund CS intersected with debates over the intellectual status of “applied science” and external pressures to make science serve social needs. Through a variety of rhetorical and political strategies, CS advocates were able to claim epistemological respectability for computer science and shape its trajectory for years to come, while leaving underlying tensions unresolved.

Author: Pnina Abir-Am

Title: The ‘Theoretical Biology Club’ in London, the ‘Delbrück Seminar’ in Berlin, and the ‘Club de Physiologie Cellulaire’ in Paris: Social Origins of Collective Creativity in Early Molecular Biology

Abstract: The prevalence of “clubs” in the early days of molecular biology (1930s-1940s) raises the question of the role of such or informal social formations in fostering the collective creativity that later became a hallmark of molecular biology. In this field, many discoveries (as well as less well known work) reflected and depended upon collaborative opportunities that were greatly strengthened by means of science policy in the aftermath of WW2. (e.g. DNA structure in 1953, semiconservative replication of DNA in 1958; messenger-RNA in 1961, the operon in 1961, allostery in 1965) This talk compares three such early clubs in terms of their theoretical interests, social composition, political ideology, and collaborative legacies. The three clubs to be compared are: the “Theoretical Biology Club” in Greater London during 1932-1938, which pioneered the discourse on protein structure as the “first” secret of life, a topic which became the key part of early molecular biology; the “Delbrück Biophysics Seminar” in Berlin which pioneered new physical approaches to genetic mutation; and the “Club de Physiologie Cellulaire” in Paris, which pioneered new biochemical approaches to protein synthesis, yet another key topic in molecular biology. Such a transnational approach is necessary if we are to avoid the pitfall of singular “origins” for a field which produced different research schools in different countries.

Author: Rodolfo Alaniz

Title: The Biotic Debate and the Disruption of Transatlantic Marine Naturalist Networks

Abstract: In 1853, American naval naturalists developed a way to collect sediment samples from the deep sea, an almost unexplored geography for zoologists and geologists. These samples challenged dominant beliefs about the existence of life in deep marine environments. The availability of these rare samples determined who could participate in the resulting scientific controversy, known as the biotic debate by American contemporaries. Those sediment samples traveled along nineteenth-century transatlantic scientific networks for almost a decade. An international community of scholars emerged based on the circulation of those samples. However, the outbreak of the US Civil War interrupted the production of the samples. This presentation explores the effect of the US Civil War on the biotic debate, including the dissemination of valuable samples along prewar networks, the scattering of American naturalists across the Atlantic during the war, and the ways that international collaborators adapted to the spread of new marine science practices. A focus on the disruption of transatlantic networks highlights new figures, such as Louis François de Pourtalès, a member of the US Coast Survey and protégé of Louis Agassiz, and their roles in nineteenth-century geology, zoology, and marine science via the biotic debate.

Author: Amir Alexander

Title: Geometries of Power

Abstract: Euclidean geometry served as the embodiment of timeless, universal Truth in early modern Europe. Based on simple self-evident assumptions, and proceeding step by logical step to absolutely certain condition, it was viewed as a model of unchallengeable stability and order in a strife-ridden world. This gave geometry enormous political cachet, as rulers, administrators, and reformers all claimed geometrical authority for their designs. This was most explicitly the case for absolutist rulers such as Louis XIV, who made the geometricism of Versailles a pillar of his rule. But it is also true of social reformers who insisted that the commerce-friendly and egalitarian geometrical grid was the natural city plan for the burgeoning American republic.

Author: Hanne Andersen, Anne Markovich, and Terry Shinn

Title: Disciplinarity Studies and the ‘New Disciplinarity’ in Nanoscale Scientific Research

Abstract: First, this talk will provide a brief overview of studies of disciplines and interdisciplinarity within HPSS. In the early phase, HPSS studies of disciplines and their development revealed that the structure of science and its development displayed a complexity that did not easily lend itself to simple, generalized accounts. Later, interest in HPSS turned away from generalized accounts of structure and development and turned instead towards micro-studies of the particular, including scientists’ local collaboration across disciplinary boundaries that was analyzed through notions such as boundary objects or interactional expertise that tend to emphasize fluidity and blurred boundaries. Next, the talk will provide a new framework for the analysis of 20th century disciplines exemplified by nanoscale research. We analyse the cognitive processes and work structure and dynamics of research exhibiting a particular form that has gone unnoticed in explorations revolving around the opposed paradigms of traditional disciplinarity versus today’s interdisciplinarity. This recent form of discipline, we term the ‘new disciplinarity’. Our examination of disciplines through the study of the nanosciences focuses on processes of cognition. Our survey in nanoscale research laboratories has brought to light five key features of the new disciplinarity - “disciplinary referent”, « borderland », “project”, “displacement”, and “temporality”. These components contrast with traditional disciplinary inward-looking statics, and with interdisciplinary unbounded dedifferentiation and fluidity. We suggest that the emergence of the new disciplinarity is linked to the extension and impacts of intellectual, instrument and materials genericity in contemporary science.

Author: Rachel Ankeny and Heather Bray

Title: The Beginning of an ‘Exceptional Era’ in Australia?: Early Genetic Modification Research Regulation and its Implications for Public Understanding of Science

Abstract: By 1974, concerned scientists called for a voluntary research moratorium on deliberate molecular recombination of DNA and convened the international 1975 Asilomar conference, claimed 20 years later by two of its key participants to have marked the beginning of an ‘exceptional era’ not only for science but public discussion of science policy (Berg & Singer PNAS 1995). The impacts of this historic event on science and policymaking beyond the U.S. have not been well-documented: this paper seeks to remedy this lacuna in the case of Australia, often lauded as a model for scientific governance

of genetic modification (GM) technologies. Within months after Asilomar, one of the first GM regulatory bodies in the world was established in Australia, composed primarily of scientists doing recombinant DNA research, and processed research applications. Using documentary evidence and oral histories, we trace the evolution of GM regulation in this early period, and argue that this type of high-level voluntary regulatory structure, together with high levels of public trust in science, limited opportunities for involving the Australian public in discussion of the potential non-scientific consequences of GM research. This situation delayed the development of strategies to engage the public in science policymaking, and contributed to the moratoria on commercial growth of GM crops in the 2000s in most states. We contend that this history reveals that public involvement in policymaking in the earliest stages of emerging science is essential for effective scientific governance. This project is supported by a grant from the Australian Research Council.

Author: Theodore Arabatzis and Kostas Gavroglu

Title: Revisiting the Discovery of Argon

Abstract: Thomas Kuhn has argued that scientific discoveries are extended processes that cannot be precisely dated. In this paper we will draw upon Kuhn's insight to revisit the discovery of argon in the atmosphere by Lord Rayleigh and William Ramsay. We will argue that to understand how argon was detected and conceptualized we need to bring in historiographical considerations about the nature of scientific discovery. In the main announcement of their discovery on 31 January 1895, Rayleigh and Ramsay were careful to point out that it was unclear whether the novel gas was an element or a mixture of elements. Furthermore, argon did not react with other elements. Up to that time, reactivity had been a constitutive property of elements. Thus, the discovery of argon could not have been accepted by chemists without a reconceptualization of 'element'. Furthermore, there were difficulties with the accommodation of argon in the Periodic Table. The discovery of argon was complete only after those conceptual difficulties had been removed. This is why it has to be understood as an extended process, rather than as an event. Furthermore, we will suggest that the case of argon indicates that scientific discoveries are extended processes for reasons that go beyond those envisaged by Kuhn, namely because they may involve controversial experimental techniques and methods. As we will show, some of the factors that complicated the discovery of argon were related to the legitimization of physical techniques of investigation in chemistry and the emergence of physical chemistry.

Author: Marcelo Aranda

Title: Fruit of the Ignatian Tree: Jesuits and their Students in the Circulation of Mathematical Knowledge in the late Seventeenth Century Spanish Empire

Abstract: In his *Ars magna lucis et umbrae*, Athanasius Kircher produced a schematic map depicting the seventeenth century network of Jesuit missions and schools as a gigantic olive tree. Kircher highlighted the global nature of the Society of Jesus by declaring, "From East to West, praiseworthy is the name of the Lord." Of the thirty-nine provinces within the tree, seventeen lay within the Spanish Empire, the largest Catholic monarchy in the early modern period. The Jesuits used both their religious and scientific knowledge to convert new territories and educate students throughout the empire. The Society of Jesus was able to accomplish these evangelical and pedagogical goals through the support of both the Crown and influential Spanish aristocrats. Drawing on interactions among Jesuit mathematicians, missionaries and aristocrats this paper will argue that through their patronage, aristocrats were significant scientific actors in the Spanish context, in effect, forming a parallel network emerging from the well-known Ignatian Tree.

Author: Nobumichi Ariga

Title: Euler's Mechanics as Opposition to Leibnizian Dynamics

Abstract: Leonhard Euler's *Mechanica* (1736) is regarded as one of the most important works in the history of mechanics. By overlooking the contemporary influence of Leibnizian dynamics, however, historians of science have failed to identify what was truly innovative in Euler's thought. "Dynamics" was originally proposed by Leibniz, who defined it as a new science of *vis viva* (living force). This kind of force is involved with bodies in motion, and it is set opposed to *vis mortua* (dead force), which tends only to produce motion. Insisting on the difference between these forces, Leibniz distinguished "dynamics" from "mechanics," the ancient science of machines. The Leibnizian conception of two classes of force, and therefore the separation of two sciences, was accepted by several philosophers and mathematicians, including Johann Bernoulli, Euler's mentor. The Leibnizian view of *vis viva* was also dominant in the Academy of Sciences in St. Petersburg when Euler joined it. Some works from early in Euler's career show the marked influence of Leibnizian dynamics. At the same time, however, Euler adopted another concept, *potentia*. Referring to the action of push or pull, it was common in discussions on machines. Euler employed it to examine the collision of bodies and declared that statics, or the science of *potentia*, should precede the study of motion ("mechanics" in Euler's terminology). Euler's mechanics was a

science of motion based on mechanical forces, thus uniting two sciences. This concept of mechanics was, in itself, a critical opposition to the Leibnizian program for "dynamics."

Author: Sabine Arnaud

Title: Deafness, Language, and Human Evolution: Accessing Inner Life and Competing for One's Discipline in Late Nineteenth-Century France

Abstract: In his work *Physiology of the Voice* (1866), Edouard Fournié expresses his surprise at the absence of studies on the mysteries of the "formation of speech," adding that he does not mean exterior speech, rather the "intimate, silently spoken thought" that is then manifested through speech. His work was followed by a wealth of treatises on deaf people in which experimental psychology, psychiatry, anatomy, and anthropology—to name just a few disciplines—competed in better understanding thought processes and their relationship to language. Medical, psychological, and medical discourses saw deafness as an opportunity for pondering on the role and form of the inner voice, and on the transition from emotional to abstract language. In an effort to delineate a physiology and a psychology of thought, they described "verbal images," "acoustic images," "primitive language," "interior speech," and "psychological and organic signs." While language had long been identified as a human characteristic, difficult speech acquisition and the use of sign language made deaf people exemplary cases for examining the workings of the mind. However, a broader redistribution soon took place. From an exemplary case, deafness was reinterpreted as an abnormality, and a hierarchy was established between different accesses to and forms of inner thought. This paper will analyze how these divisions would come to categorize different types of people (backward, imbecile, feeble-minded) and how the ability to access the inner self became the criterion used by the new areas of scientific and legal competence in carving out a role for themselves.

Author: Elena Aronova

Title: Doing Things with Data: The Politics and Practices of the World Data Centers, 1950s – 1970s

Abstract: This paper discusses the role of the World Data Centers – "data archives" organized to serve the International Geophysical Year (IGY, 1957-8) – in enabling specific practices of data-use in physical environmental sciences. I will first discuss how, in the 1950s and early 1960s, the practices of data exchange in the physical environmental sciences shaped and were shaped by the Cold War political economy, turning the IGY data into the "exchange currency" in possession of two "countries-keepers" of planetary geophysical data: the USA and the USSR. After establishing this background I will then discuss how the system of data exchange created a distinct data regime that justified the accumulation of data as an end in itself. Accumulating data in variety of different formats the WDC evolved into a big distributed archive of "curves, maps, and films," representing a climax of the world of analog data just as computers started to take center stage. On both sides of the iron curtain, the WDCs struggled with handling their data, however the particular technological choices made to deal with "curves, maps, and films," as well as texts, photographs, etc, differed on different sides of the iron curtain. I argue that the practices of handling the data in the physical environmental sciences were intertwined with the politics of the environmental data archives.

Author: Tuna Artun

Title: A Gift to the Sons of Rum: Turkish Alchemical Poems of the Seventeenth Century

Abstract: Very little work has been done to date on the prolific literary activities of Ottoman alchemists during the long seventeenth century (ca. 1575-1700), and virtually none on texts that were composed in verse. The prioritization of prose over poetry in modern studies is all the more unfortunate as poems constitute the earliest expressions of alchemical knowledge in the Turkish vernacular. Just as importantly, the sheer number of their manuscript copies is suggestive of a wide readership. The present talk will offer some preliminary thoughts on Turkish poems about alchemy by focusing on the intellectual horizons of their composers. Such a focus necessitates an evaluation of these poems' contents, with a specific reference to their Arabic antecedents, which clearly served as a model for Ottoman alchemists. A further consideration is the link between alchemy and Sufism, a relationship that is often acknowledged but rarely substantiated. It will be argued that the choice of poetry as a medium is of the kinds of circles that produced this vernacular knowledge in Ottoman society. Three groups of poems will be utilized for the purposes of the talk: the *Qaside-i sirr-i TaHa* ("Poem of the Secret of TaHa") and its unusual commentary, the latter of which was ascribed to the founder of the Eshrefi Sufi order; two versions of the *Divan-i Hikmet* ("Anthology of Wisdom"), by far the longest surviving Turkish alchemical poem; finally, a number of much shorter and pseudonymous poems that were commonly copied together and thus form a versified cycle.

Author: Elizabeth Athens

Title: An Inimitable Picture: Dynamic Perception in William Bartram's Natural History

Abstract: The drawings of Philadelphia artist-naturalist William Bartram (1739–1823) suggest the work of a peculiar mind or untrained hand. In particular, they fail to meet criteria for “accuracy” in eighteenth-century natural-history representation, which heavily depended on establishing a sense of transparency. Specimens were excised from their environments and slotted into shallow representational spaces to create, in Susan Scott Parrish’s phrase, “transparent windows rather than substances in themselves.” Bartram’s graphic work also features complex formal associations and visual citations that cannot simply be attributed to personal peculiarity or colonial naiveté. I argue that his drawings willfully reject the bond between transparency and accuracy, offering instead a representational model that emphasizes mediation, opacity, and an unfolding haptic “dynamic perception” as the basis for knowledge. In this paper, I focus on Bartram’s drawing of an American lotus, great blue heron, and Venus flytrap (ca. 1767), made for the London mercer Peter Collinson. The specimens he portrays represent more than mere things in the world; they serve as emblems that encode his acquisition of knowledge: his close study of Linnaean systematics, his incorporation into the epistolary interchange among naturalists, and his experience of the specimens in situ. These emblems are connected through a series of formal rhymes that lead viewers through the drawing’s different stations, allowing them to re-experience Bartram’s own pursuit of knowledge, as he lays bare his mediating role. Rather than offer a simulacrum of the natural world, his drawing maps out the means by which he comes to know and understand it.

Author: Elise Aurières

Title: George Sarton and Alexandre Koyré: Two Messengers of the History of Science

Abstract: Alexandre Koyré arrived in the United States in 1941 at the same time as many of the intellectuals chased away by the rise of Nazism in Europe. George Sarton was not part of this wave of immigration. He was in the United States since 1915 and had become an iconic figure in the development of the history of science. Among other things, he had already created Isis and Osiris, founded the History of Science Society and supervised the first PhD students in history of science. However, in the 1950-1960s, the pioneers of the history of science as a discipline insisted on the influence of Alexandre Koyré. A lot of accounts agree that Koyré's lectures have played a decisive role in American university culture. Indeed, although Koyré came back to France at the end of World War II, he made regular travels to the United States until his death in order to share his ideas. The goal of this communication is to understand how Koyré renewed the intellectual landscape in which he was inserted at the beginning of the 1940s. The appropriation of the ideas of Sarton and Koyré by a number of American historians and philosophers will serve as a guideline.

Author: Alexandra Bacopoulos-Viau

Title: Dispatches from the Beyond: The Medium as Telegraph in Early French Spiritism (1857-1869)

Abstract: This paper illustrates the complex ways in which Allan Kardec (1804-1869), the founder and theoretician of Spiritism, attempted to legitimize his new movement during its early foundational phase by allying it with the positivistic sciences. His approach was twofold. The first main strategy that he employed was to modify the representation of the medium. By explicitly likening mediums to scientific instruments—veritable “communication machines”—, Kardec wished to increase the legitimacy of his nascent movement and to differentiate it from Anglo-American Spiritualism. The second strategy was to endow mediumistic writing with a special epistemological status. These celestial scripts became for Kardec and his disciples a superior means of accessing the otherworldly message. By offering what came to be referred to as objective proof of the Other World, this inscriptive technique helped the expansion of Spiritism at the close of the French Second Republic.

Author: Massimiliano Badino

Title: Boltzmann in Oxford: How Mathematics Molds Physical Concepts

Abstract: In 1894 the Austrian physicist Ludwig Boltzmann crossed the Channel to receive a honorary doctoral degree in Oxford. He then starred in the conference of the British Association for the Advancement of Science, a meeting he later recollected as “unforgettable”. While in the German-speaking countries his work, albeit highly respected, was scarcely read, Boltzmann’s statistical mechanics seemed to receive in Britain a well-deserved appreciation. A few weeks later, stimulated by the discussions at the meeting, E. P. Culverwell published a letter in Nature in which he asked for some clarifications

about the meaning of the H-theorem and the thermodynamic irreversibility. Culverwell's seemingly innocent paper stirred up one of the liveliest debate of 19th century physics. For several months, the most renowned experts of Britain as well as Boltzmann himself, debated Culverwell's challenge in the columns of *Nature* and, too much of their surprise, they found themselves in disagreement. The problem of irreversibility has both a mathematical and a physical side and solutions could differ remarkably, depending on which side was considered as prevalent. Later, this debate led Boltzmann to develop the concept of molecular chaos, one of the most exotic and obscure notion of statistical mechanics. In this paper, I reconstruct the *Nature* debate and I argue that conceptions of physical irreversibility, particularly molecular chaos, depended essentially on the mathematical practices adopted.

Author: Tawrin Baker

Title: Performing Early-Modern Dissections and Experiments on the Eye

Abstract: Early-modern anatomy books were not meant to be passively read, but in most cases actively performed. This is especially true of Fabricius ab Aquapendente's (1533–1619) anatomical works: his texts follow the Galenic format of structure, action, and use, a sequence that is supposed to lead to complete knowledge of the part or organ under consideration. Fabricius also distinguishes dissection as a crucial fourth step, but this involves direct sensation, and is therefore necessarily extra-textual. Achieving the goal of his anatomical project—to guide his audience to *scientia* of the universal animal—first required seeing and touching animal bodies during dissection. Yet these dissections occurred in Padua at a particular time of the year and were performed in a particular way. These local circumstances were an important factor in Fabricius' account of the eye and his interpretation of past anatomical, optical, and philosophical texts. Recreating some of these local dissection conditions and replicating his experiments on the eye gives insight into Fabricius' account of the crystalline humor (now called the crystalline lens), which since Galen was considered the site of vision. This insight also extends beyond Fabricius' works: performing the Paduan's ocular dissections helps us understand a whole class of visual theories, illuminates the meaning of several obscure terms (such as intentional species and optical density), and provides a new perspective on the transition from crystalline- to retinal-centered theories of vision in the seventeenth century.

Author: Marina Baldissera Pacchetti

Title: Turning Music into Sound: Vincenzo Galilei's Contributions to Acoustics

Abstract: The contributions of Vincenzo Galilei (1520 - 1591) to the development of acoustic science are investigated. Sixteenth century music theory, as formulated by its major exponent Gioseffo Zarlino (1517 - 1590) relied on a priori mathematical quantification of sound based on Pythagorean ratios, which were used to justify the consonance of contemporary music. The application of tuning systems that aimed at recovering these ratios to sixteenth century polyphonic composition lead to a discrepancy between music theory and music practice. The humanist philologist Girolamo Mei (1519 - 1594) argues that this discrepancy is due to a misinterpretation of the division between the inquiry of sound as physical system and the practice of music by contemporary music theorists. After having studied under Zarlino, Vincenzo turned to Mei for clarifications on his interpretation of music theory. Under the influence of the teachings of Mei, Vincenzo refutes Zarlino's approach, introducing a novel empirical, systematic description of sound, contributing to the birth of acoustics. Furthermore, the study of Vincenzo's experiments (*esperienze*) in their historical context provide another perspective on the relation between the development of scientific inquiry and perception. This, I suspect, is driven in part by the reception of the work of ancient Greek literature on music theory, especially the work of Aristotle's student Aristoxenus.

Author: Melinda Baldwin

Title: Useful or Merely Excellent? Evaluating Proposals at the National Science Foundation, 1951-1976

Abstract: Following the creation of the National Science Foundation in 1951, experts outside the NSF were recruited to evaluate the quality of funding proposals. The initial purpose of this referee process was to advise the NSF program directors, not to dictate decisions. During the height of the Cold War few questioned the NSF's funding choices. In 1975, however, Senator William Proxmire of Wisconsin publicly called out five NSF projects that he believed were a waste of taxpayer money. As the controversy developed, NSF director H. Guyford Stever was called before the Senate to defend the NSF's spending decisions. Congressional critics argued that the NSF was funding projects with no potential use for the American people and subsequently proposed that the NSF should have to receive Congressional approval for any grants it wanted to fund. In response, Stever argued that peer review was the scientific community's best method of distinguishing high-quality proposals from poor ones, and the NSF reformed their grant-giving process to place more weight on referee reports. The strategy was successful; the suggestion of Congressional review for NSF grants was dropped. Ultimately, the NSF controversy represented a clash between two different standards for assessment: Stever and the NSF wanted to choose

proposals based on scientific interest, while Proxmire and his allies wanted to assess a proposal's usefulness to the government that was funding it. The episode also reflects a growing emphasis on external peer review as a means of assessing scientific quality during the second half of the twentieth century.

Author: Somaditya Banerjee

Title: Periphery on the Centre: C.V. Raman, Colonial Physics and Indian Modernity

Abstract: This paper examines how physicists worked in colonial India early in the twentieth century. Using the case study of C.V. Raman, my paper analyzes how Raman established himself as a scientist under colonial rule, developed strong international networks and how he sought meaningful connections between a modern scientific worldview and the indigenous knowledge of India. I argue that although the Raman Effect had been generally seen as providing a strong evidence for the quantum nature of light, Raman himself used to be a staunch supporter of the classical wave theory of light. Raman's faith in the wave theory, I suggest, came from his initial interest in the physics behind several ancient Indian musical instruments. Historians have been compelled recently to move away from former historiographical binaries like creative producers versus passive recipients and consumers, and contrasting the production of knowledge with its transmission. The vertical model of diffusion has been superseded by a horizontal conception of circulation and appropriation of science, which gives voice to various "peripheral" actors and to their different, often contradictory, agendas. Very few works have examined the history of physics in Asia and hence my paper contributes richly to this apparently neglected area of study and is a major contribution to the historical development of physical science outside the Euro-American context.

Author: Sultana Banulescu

Title: From "Lifetime Psychosis" to "Wartime Neurosis:" How Italian Mind and Brain Sciences Escaped from the Asylum during the Great War

Abstract: In the approach to the centenary of World War I, what little discussion there has been of wartime mental trauma has focused on victims' suffering rather than on scientists' attempts to understand it. Furthermore, this discussion is generally limited to the Western Front, leaving Italy almost wholly neglected. Yet, it was in Italy where neuroscientists' efforts to alleviate the "invisible wounds" inflicted on soldiers would profoundly affect the direction and status of mind and brain sciences as well as the way the war was perceived in the broader society. Drawing from Italian-language primary sources (war diaries, brochures, pamphlets, and scientific periodicals such as "Rivista di psicologia applicata alla pedagogia e alla psicopatologia" and "Rivista sperimentale di freniatria"), this paper shows how the war enabled Italian neurologists and psychologists to extend work once confined to mental asylums ("manicomi") to the larger, far less marginal population of traumatized soldiers. In doing so, Italian mind and brain scientists themselves moved from the fringes to the centers of prestige and power. Specialists who before the war languished as provincial mental asylum staff would during and after the war rise to prominence in nationally- and internationally-recognized scientific journals. Celebrated in the 1920s as "alienisti," i.e. researchers who studied the mechanisms of alienation, these neuroscientists played a major role in shaping the Italian wartime and interwar political discourses.

Author: Michael Barany

Title: The Sense and Sensibility of Distributions

Abstract: The theory of distributions, developed in the mid-1940s by the French mathematician Laurent Schwartz, was among the first and most prominent innovations in mathematical analysis to emerge in the second World War's wake. Schwartz presented his theory, for which he received one of the first postwar Fields Medals, as a generalization of the mathematical concepts of functions and derivatives. He thus cast numerous notions, methods, terms, and intuitions in a new framework said to be more complete, rigorous, fruitful, and profound. To signal this different framework, the theory's users began referring to concepts "in the sense of distributions" and referring to the theory itself (whose own name Schwartz borrowed from within the theory of probability) as "distributions in the sense of Laurent Schwartz." This taxonomic turn of phrase, "in the sense of," can be read unconventionally to invoke the sensory manifestation of the theory of distributions and its famously energetic progenitor. On the one hand, following the rapid spread of the theory of distributions during its first decade permits an account of the distinctive sights, sounds, smells, tastes, and other sensations that would come to characterize the renewed postwar international mathematical community. On the other hand, such a sensory history can account for the peculiar sensibility of an abstract and theoretical discipline widely believed to subsist in the disembodied mind alone.

Author: Antonio Barrera-Osorio

Title: Translating Empiricism: Spanish Books, Protestant English Translations, and the Invisible Early Modern Science of the Atlantic World

Abstract: The Spaniards faced difficult epistemological problems in America. They found themselves surrounded by people, trees, avocados, pineapples, corn, manatees, flying fish, unfamiliar stars, volcanoes, and rivers; they found themselves sometimes in cities built in islands or high in the mountains, or next to communities that disappeared in the morning. Few Europeans bent their classical traditions to explain the place of America in the world but most accepted the fact that classical traditions did not really made references to America, its people, its avocados, iguanas, and constellations. How to know this reality? Haphazardly, the Spaniards established practices to gather information and produce knowledge about the America. They embedded these practices in the books they wrote about navigation, natural science, medicine, and histories of the New World. The English translated most of these books in the late sixteenth and early seventeenth centuries, which gave them access not only to information about the New World but also to those practices I mentioned above. This paper discusses these translations.

Author: Joe Bassi

Title: Successfully Navigating Scientific Borderlands and Subcultures: Astronomer Walter Orr Roberts, The Sun-Earth Connection and the National Center of Atmospheric Research

Abstract: The National Science Foundation created the National Center for Atmospheric Research (NCAR) the US's premier location for atmospheric studies. Walter Roberts helped create NCAR in the late 1950s and then became its first director. Roberts, however, was neither a meteorologist nor atmospheric physicist. He was rather a well regarded solar astronomer who had never done any research directly in atmospheric physics. The question arises, how did a scientist with minimal background in atmospheric physics become the founding director of a major research institution for this field of scientific investigation? This paper shows how Roberts negotiated between two disparate scientific subcultures---astronomy and meteorology---by exploiting a disciplinary borderland between these fields, the study of the sun-earth connection. Specifically, he was able to obtain cache in the meteorological community by his deep and lasting interest in sun-weather studies. It is interesting to note that Roberts came to these studies as an attempt to demonstrate the practical applications of solar research in order to entice sponsorship from private donors. Although not known for any widely recognized research in atmospheric physics, his interest in the science of the sun-weather connection enabled him to develop communion with many in the meteorological community of the 1950s. By navigating this sun-earth scientific borderland and having the reputation as a successful scientific administrator, Roberts then quickly became a prime candidate to be NCAR's founding director. His experience illustrates that the existence of scientific borderlands such as the sun-earth connection can have important ramifications for the development of the disciplines.

Author: Julian Bauer

Title: Experimenting with Thoughts, Experimenting with Scripture: Ernst Mach On and In Thought Experiments

Abstract: "The planner, the builder of castles in the air, the novelist, the author of social and technological utopias is experimenting with thoughts; so, too, is the hardheaded merchant, the serious inventor and the enquirer." (Mach 1976: 136) These provocative lines uniting fact and fiction continue to inspire debates in the history and philosophy of science today. While most commentators have focused on epistemological reconstructions of Mach's point of view, my paper tries to take a contextualist, practice-centred approach. This leads me to two strands of his everyday work and life. Mach was on the one hand a vocal supporter of a reformist pedagogics that relied on using thought experiments as exemplars to educate pupils and students. This dimension of Mach's thought will be demonstrated both by perusing through his articles as well as his lectures, and might well be understood to form an important part of the genealogy of Thomas Kuhn's 'paradigms' (Isaac 2012). Behind Mach's polished publications lurk, on the other hand, his scribbles bursting with spontaneity that are mainly contained within a huge amount of notebooks. Mach's paperwork is a versatile device to come up with new ideas and insights (Hoffmann 2013). This perspective crucially helps us in understanding Mach's thought experiments less as strictly rational and goal-directed activities than in fact as iterative and embodied processes of cognition that involve trial and error, mind and matter, factual and fictional data, complicating any neat division of what came to be called the 'two cultures' of scientific inquiry.

Author: Nadia Berenstein

Title: Making Flavor Objective: Tasting Panels, Sensory Science, and Flavor Research, 1945-1977

Abstract: This paper, based on my ongoing dissertation research into the history of flavor additives in the U.S., examines attempts to develop objective methods for the sensory analysis of flavors and foods in the decades after World War II. In both the federal government and private industry, a heterogeneous group of practitioners devised tools and techniques for distinguishing, describing, and defining the experience of flavor. Despite diverse disciplinary backgrounds, these investigations shared a common technology: the tasting panel. Comprising ordinary consumers, trained participants, or expert tasters, these panels were called on to provide judgments about detectable differences, sensory thresholds, organoleptic effects, and affective responses. My paper traces the development, use, and evolution of two analytic procedures for assessing the experience of flavor: the "flavor profile method" and the "hedonic scale." I document efforts to standardize technologies, vocabularies, practices, and bodies in order to produce "objective" scientific knowledge about the senses, control product quality, and influence food consumption habits. Despite the increasing formalization of tasting panel practices, researchers continued to struggle to produce "objective" quantifiable results, find material correlates for reported sensory experiences, and account for the intersubjective dimension of flavor. Drawing on recent scholarship in the history of the senses and the sciences of subjectivity, this paper considers issues including: the production and status of scientific knowledge in industrial settings; the epistemological, social, and technical challenges attending the translation of human sensory experiences into usable data; and the ontological questions raised by the installation of flavor as a scientific object.

Author: Staffan Bergwik

Title: A Shared Sense of Curiosity: Sven Hedin and the Public Yearning for Geography in the Early Twentieth Century

Abstract: This paper concerns how a sense of curiosity, a yearning for knowing the unknown, was circulated and cultivated through public knowledge making in early twentieth century geography. My empirical focal point is the Swedish explorer Sven Hedin who undertook four expeditions to Asia between 1893 and 1935. He became influential in international geography and a European celebrity; his books, articles and lectures, were best sellers. Indeed, there was a keen interest in scientific expeditions at the time. The paper asks how the cultivation of curiosity enrolled audiences in geography as a scientific field. How was curiosity created and managed? How did it teach the public to feel like discoverers? At the time, actors at universities tried to give geography disciplinary unity, while its public character remained. What role did curiosity play in this context? As emerging research has discussed, curiosity has historically been regulated in order to become a scientific sentiment rather than frivolous fascination. How did this tension play out in geography? The paper thus traces the historical construction of a modern desire to see the world in an exploratory mode: how was that desire produced, suppressed and cultivated collectively? My methodological claim is that publications and popular presentations were among the arenas where "emotional communities" were shaped. The circulation of scientific emotions shaped a modern and shared yearning for the geographically unknown.

Author: Paola Bertucci

Title: Material Networks: Artisans, Savants and Metals in Early Eighteenth-Century France

Abstract: This paper examines how metals created connections between heterogeneous social actors in early eighteenth-century France. It focuses, in particular, on the relationship between the academician René Réaumur and a group of artisans and savants who worked at the Paris Mint. It analyses the Mint as a citadel of metallurgical knowledge that served simultaneously the state and the private interests of its members. Réaumur and his associates at the Mint were among the main responsible for setting up a Royal Manufacture of Steel and Cast Iron based on Réaumur's principles. The paper follows the (mis)fortunes of this enterprise and the subsequent fellowship of the same group of artisans and savants in the SOciété des Arts, an assembly dedicated to the improvement of the mechanical arts. By reconstructing the networks created by work on metals, this paper raises broader questions about the role of artisans in the Republic of letters.

Author: Richard Beyler

Title: Biophysics without Molecular Biology

Abstract: Perhaps understandably, the historiography of the relations between the physical sciences and biology in the early

20th century has been dominated by interest in development of molecular biology in the middle decades of the century. At its best, the retrospective examination of the creation of the spectacularly successful interdisciplinary field of molecular biology has provided a rich and sophisticated picture of conceptual and institutional change. Sometimes, however, the canons of molecular biology have overshadowed our view of biophysics and judged it on the basis of how close scientists were to discovering the structure and function of DNA as the genetic substance. This paper aims as a prospective, not a retrospective, look at biophysics in the 1920s and '30s, and '30. At institutions such as the Curie Institute in Paris; the Kaiser Wilhelm Institutes for Brain Research and Metals Research in Berlin-Buch and Stuttgart, respectively; and the Institute for the Physical Foundations of Medicine at the University of Frankfurt, experts in the apparatus and theories of the new physics radiation, particles, quantized energy—collaborated with medical practitioners and biologists to investigate living organisms at hitherto unattainably small dimensions. In their own discourse, their quest was not to find the secret of the gene though they were certainly informed and excited by contemporary genetics but rather to expose of a more amorphously and heterogeneously conceived set of submicroscopic agents whose working became statistically significant at the cellular or organismic level. Genetics was only one (small) part of this story.

Author: Donna Bilak

Title: The Alchemical Emblem Book and Early Modern Game Theory: *Atalanta fugiens* (1618)

Abstract: Published on the eve of the Thirty Years' War, Michael Maier's famous emblem book, *Atalanta fugiens* (1618) is an allegorical paen to wisdom achieved through alchemical knowledge and praxis. While emblem books, which paired images with texts and mottoes, were widely read in early modern Europe, Maier gave the genre an alchemical twist. His work is distinguished by a three-part vocal score that accompanies each of the *Atalanta*'s fifty emblems: thus, certain emblems describe alchemical processes and equipment, while the music evokes elemental interactions. But Maier's *Atalanta* is much more than an elegant audio-visual articulation of alchemical theory and practice for producing the philosophers' stone - the panacea that would restore perfect health and longevity to humankind. Probably composed to attract patronage, and to gain access to the elite courtly circles that patronized hermetic scholarship and alchemical experimentation, the book functions as a game or puzzle that the erudite reader must solve, decode, play. This study aims to reconstruct both Maier's multi-dimensional intellectual and spiritual exercise, and the trans-disciplinary nature of alchemical methodology. *Atalanta fugiens* fuses poetry, iconography, music, mathematics and Christian cabala to extol hermetic wisdom, while evoking alchemical technologies and laboratory processes. By analysing text, image and music together, I offer a re-assessment of early-modern reading practices through the lens of this many-layered work. At the same time, I seek to resituate Maier's alchemical project within the wider cultural and intellectual context of seventeenth-century Europe, and understand why Maier created this particular work at this particular historical moment.

Author: Sara Black

Title: Cause and Cure: Psychotropic Drugs and Negotiations of Mental Pathology in Nineteenth-Century France

Abstract: From Jacques-Joseph Moreau's research into the use of hashish as a cure for madness in the 1840s to Jean-Martin Charcot's use of morphine to control his patients' hysterical episodes at Salpêtrière Hospital in the 1880s, French aliénistes turned to psychotropic substances as crucial therapeutic tools in the rehabilitation of pathological mental states. At the same time, medical-legal experts and policy makers feared the rapid spread of "morphine-mania" throughout society, treating psychotropic drugs as dangerous substances that produced pathological mental states in "normal" individuals. In the mid-nineteenth century, doctors justified prescribing considerable quantities of morphine and ether for mental patients by claiming that these substances did not affect them in the same way. However, by the 1880s, they began to realize that morphine addiction on asylum wards had become a serious problem, calling into question their previous assumptions. This paper analyzes the medical community's dual construction of psychotropic drugs as therapeutic tools and corrupting agents of mental pathology. Contemporary psychology considered many mental pathologies to be biologically rooted in heredity or physiology. Aliénistes' belief that psychotropic drugs could produce dramatic and potentially long-term changes in both "pathological" and "normal" brains suggests that they viewed mental states as malleable; yet the two radically different anticipated outcomes of drug use, rehabilitation or degeneration, simultaneously reaffirmed essentialist notions of normal and pathological. This paper examines the contradictory positioning of psychotropic drugs as medical researchers grappled with definitions of mental pathology and fragile constructions of the normal and pathological in human identity.

Author: Rens Bod and Johanna Sprondel

Title: Patterns in Humanities and Sciences: Aller-Retour

Abstract: Contrary to common wisdom, the search for invariants and patterns has not been exclusive to the sciences, but rather reaches far into the humanities' own tradition. In this talk we will argue that beyond the well-known Renaissance tradition, the humanities have a "modern" tradition of pattern-orientation that may also be considered essential in understanding the recent digital turn in and beyond the humanities practices. Drawing from our recent books (*Bod: A New History of the Humanities*, OUP, 2013; *Sprondel: Towards the 'Humanities of the Digital'*, forthcoming), we will argue that the search for patterns is found across disciplines and regions, e.g. in stemmatic analysis in philology (Lachmann), formalism in literary theory (Propp), stylistic analysis in art history (Wölfflin), and the Annales school in historiography (Febvre). These examples raise questions about the nature of the divide that has been created repeatedly between science and humanities. Not only will we see that these humanities practices have shaped scientific practices and virtues then: the Rankean notion of historical objectivity became the model for scientific objectivity, and the philological model of a tree of texts with a common root was adapted by zoologists for describing phylogenies. But we will also see that practices that arose from the pattern-orientation in the humanities had a strong influence on the humanities overall. Finally, we show how pattern-orientation not only finds a mirroring in both science and humanities but can be considered an essential hinge, helping to understand the recent conjuncture of the two in the digital turn.

Author: Marjolijn Bol

Title: Verdigris Emeralds, Red Lake Rubies and Ultramarine Sapphires: Recipes, Reconstructions and the Historiography of Gemstone Imitations in Art and Nature, 1400-1500

Abstract: Pliny the Elder wrote in his *Historia Naturalis* that precious stones were one of the prime follies of mankind. The high value attached to some gems also stimulated the practice of imitating them with lesser materials. Pliny remarks that this practice of gemstone imitation was a rather lucrative business, writing, "... there is no kind of fraud practiced, by which larger profits are made." Since the times of Pliny, the value of precious stones not once decreased, and this is probably one of the reasons behind the fact that the practice of gemstone imitation likewise remained popular. Surprisingly, theoretical sources reveal a lot of practical know-how about gemstone imitation that is remarkably similar to the information recorded in artisanal sources, both in artworks and written records such as recipes. This paper presents a first investigation into the ways pre-modern sources, from lapidary to art theory, reveal information about the practice of gemstone imitation: on the level of technique—how were imitations of stones made? on the level of theory—what constitutes an "imitation" of a stone? and on the level of function—why were imitations of stones made? The research will be substantiated with historical reconstructions of imitation gems to provide insight into what these "fakes" might have looked like. I show that, apart from their evident use for cheating and swindling, imitation gems were studied to probe into the matter of the natural world and used as artful substitutes for real precious stones.

Author: Angie Boyce

Title: Searching the Microbial Sea for Epidemiologic Relevance: From Molecular to Genomic Epidemiology in Public Health, 1990s-present

Abstract: "With globalization, a single microbial sea washes all of humankind," observed the Director of the World Health Organization in 2001. Around the same time, the genomics community intensified its expressions of worry about how to manage and make sense of an increasing "flood" of data generated by rapidly advancing sequencing approaches. This paper examines and historicizes a current phenomenon where these oceanic metaphors for flowing microbes and flowing data meet: a shift from molecular to genomic epidemiology in public health surveillance. A major question public health scientists have confronted in this period is when and how to make genomic data "epidemiologically relevant" in the public health context, from an epistemic and infrastructural standpoint. In this paper, I analyze two threads: a broader history of molecular/genetic/genomic epidemiology in public health science from the 1990s-present and a specific case study of this shift in a US foodborne disease outbreak surveillance system in the same time period. I also describe how the two threads have come to converge, as public health scientists work to search the microbial sea for epidemiologic relevance, looking for stable biomarkers to surveil even as the microbial sea is in constant flux, developing inexpensive and scalable analysis tools amid still-high costs and complex interpretation needs, and, in an "austere" funding environment, building significant new infrastructure for translating genomics into population-level health benefits.

Author: Robert Bradley

Title: Euler's Berlin Period and the Foundations of Differential Calculus

Abstract: During his years in Berlin (1741 - 1766), Leonhard Euler was a key figure in the revitalized Berlin Academy of Sciences. He supported the academy's mission as both an able administrator and a prolific author in the pages of its

journal. Among his many publications in the academy's MEMOIRES, topics in applied mathematics are particularly well represented, including mechanics, astronomy, optics, fluid dynamics, electricity, and magnetism. However, Euler also published elsewhere and maintained his interest in pure mathematics, chiefly in number theory and infinitesimal analysis. In this talk, I survey the broad outlines of Euler's research agenda in Berlin, paying particular attention to his contributions to the foundations of calculus.

Author: Fae Brauer

Title: Becoming “Le moteur humain”: “The Art of Work” and “The Taylored Body”

Abstract: When Taylorism was first introduced in France, it led to a massive strike over the harsh winter of 1912-1913. The new ergonomic methodologies developed in the laboratory, not shop floor, by the physiological scientist, Jules Amar, were crucial in this battle against Taylorism. To turn labour into an art, to tailor rather than ‘Taylorise’ the working body, Amar extensively deployed the apparatus of science as well as those of art, particularly chronophotography. Through a remarkable series of still and chronophotographs, Amar was able to generate a reimagining of the labouring body working in unison with modern scientific instruments and technologized machinery, with no parallel in Modernist art of that time. Yet, in acting as a form of projection, Amar’s photography also reveals how the working body may have not necessarily been emancipated from technologies of surveillance and domination, but uncannily subjected to the scientist’s masochistic disciplines and sadistic punishments. Rather than Amar’s methodologies epitomizing the antithesis to Taylorism, this paper will reveal how his images latently signify that merely they constituted a different form of control technology situated at the crux of confrontation between bodies and machines. Corporeal identity denied, sadistically disciplined, the very art designed to reveal the art of work, paradoxically reveals how the worker became nothing more than a human motor.

Author: Frédéric Brechenmacher

Title: On Mathematical Practices and Cultures of Mechanics: The Secular Equation in the 19th Century

Abstract: This talk aims at highlighting the pervading influence of what used to play the role of a shared mathematical culture of mechanics in the 19th century, much before the development of linear algebra as a specific discipline. This shared culture was usually identified by references to the “equation to the secular inequalities in planetary theory.” This form of identification highlights the long shadow of the great treatises of mechanics published at the end of the 18th century. As we shall see, the culture of the secular equation is rooted on a space of intertextual relations, in the sense of the interactions between various readings of a corpus of texts. Over the course of the 19th century, the secular equation supported some relationships between mechanics and the other branches of mathematical that appear much more complex than a back-and-forth motion between application and abstraction. Not only did some specific algebraic procedures for dealing with linear systems emerge from some mechanical works. But the secular equation moreover generated a broadly shared mathematical culture in the 19th century by supporting the circulation of these procedures between various domains—celestial mechanics, analytical geometry, the theory of elasticity, the theory of light, complex analysis, the algebraic theory of forms, group theory, etc.—thereby enriching these procedures with new significations, and eventually returning to celestial mechanics with Poincaré’s *Méthodes nouvelles de la mécanique céleste*.

Author: Ben Breen

Title: Pharmacological Go-Betweens in the Atlantic World

Abstract: In the hybrid spaces of seventeenth-century Brazil, Angola, and Goa, non-European healers emerged as viable alternatives to Galenic physicians. Amazonian, African, and South Asian medical practitioners became valuable informants regarding tropical drugs for networks of natural philosophers like London’s Royal Society. Yet these “pharmacological go-betweens” were more than purveyors of knowledge: they were active consumers and sellers of novel drugs in their own right. Although the seventeenth- and eighteenth-century Portuguese world has typically been portrayed as intellectually moribund, closer attention to drugs as a category of transcultural exchange tells a different story. Quina, ipecacuanha, guaiacum bark, bezoar stones, cacao, tobacco and opium were not only objects of scientific curiosity: they were religious sacraments, valuable commodities, and icons of sociability and status. These multiple valences make their historical trajectories difficult to track, but also hugely important in establishing shared realms of experience where different epistemologies and visions of nature came into contact (and conflict). By mapping the networks of apothecaries, druggists and colonial medical practitioners, I attempt to trace these interactions. Ultimately, I argue, the trade in tropical drugs from the Portuguese helped lay the foundation for the rise of chemical medicine during the Enlightenment and the globalized pharmaceutical industry of the nineteenth and twentieth centuries.

Author: Emily K. Brock

Title: The Lie of Philippine Mahogany: Transnational Definitions of Species for Science, Power, and Trade

Abstract: This paper examines scientific classification of timber trees in the context of colonialism and capitalism, focusing on the American period in the Philippines. When the United States took power in the Philippines at the turn of the twentieth century, the commercial potential of the lush islands was immediately apparent to the American colonial administrators. The new government embedded in the Insular Commission the capacity to develop the Philippines as an exporter of natural resources and other commodities. As colonial managers turned their attention to the Philippines' forests, however, they discovered they knew little of either its merchantable tree species or its overall ecology. American tropical research focused mainly on the Caribbean and Central America, and hence was inadequate to sufficiently understand Southeast Asian forests. Further, earlier Spanish and English botanical study in the Philippine archipelago had been disorganized and incomplete. This was an economic as well as a scientific difficulty, as timber of unknown species could not be sold easily. This paper also explores disjunctures in naming Philippine trees for scientific validity and commercial benefit. For example, the complex and weighted term "Philippine Mahogany" aimed to define several Philippine species through evoking the highly-valued South American timber tree. By examining this relationship between scientific knowledge and commodification, we can trace the colonial subtexts and economic legacies of the industrial globalization of tropical forest resources.

Author: Jed Buchwald

Title: Assessing Reproductions of Past Experiments

Abstract: In recent years a number of historians have sought to understand past experiments by reproducing the specific devices, observational methods, and computations of the period. A number of salient issues arise in respect to the historical knowledge that can be gleaned in so doing. I will examine three such attempts in order to tease out their problematic aspects as well as their virtues. One of these was done over three decades ago at Toronto by myself and concerns Huygens' experiments with double refraction; the second was produced seven years ago at Caltech in collaboration with Moti Feingold and concerns Descartes' observations of the colors produced in prismatic refraction. The third attempted reproductions of Coulomb's experiments on electric repulsion, originally produced by Heering in Germany, then by Martinez at Caltech, and finally by Palmieri at Pittsburgh, all with different results. We will see that the first two did reveal aspects of the historical situation that were otherwise problematic, while the third raises intricate issues of just how close one can come to the original production in situations involving considerable skill, quite precise materials, and particularly difficult to control effects.

Author: Adelene Buckland

Title: A Day in the Life: Charles Lyell's Geological Daydreams

Abstract: Only two thought experiments in Charles Lyell's "Principles of Geology" (1830–33) have received sustained attention from historians and literary critics: the imagining of a subterranean gnome, borrowed from Alexander Pope's poem "The Rape of the Lock", as a faulty geologist; and the famous passage in which Lyell considers the return of the ichthyosaur to earth under the right climatic conditions. Indeed, some historians have assumed that Darwin differed from Lyell in the extent and range of his reliance on thought experiments (Lennox 1991). And yet, thought experiments are a resplendent feature of Lyell's prose and a crucial mechanism by which he articulates a newly imaginative, though still inductive, scientific method. Imagine, Lyell asks us, 'had the buried cities' of Herculaneum and Pompeii 'never been discovered[,] the accounts transmitted to us of their tragical end would have been discredited by the majority, so vague and general are the other narratives'. Imagine again, he suggests, a day in the life of a deer, the blowing of the wind, the fall of the tide, the hunt of an eagle, so that we may comprehend the dispersal of species across the globe through time. This paper considers the crucial role of thought experiments in Lyell's geology, arguing that Lyell borrows the structure and style of those thought experiments as much from scientific precedent as from literary predecessors – and particularly from the poets who had shaped his early reading: Dante and Lord Byron.

Author: Saskia Bultman

Title: From Body to Data: The Practicalities of Anthropometric Examination in the Dutch State Reformatory for Girls, 1905-1952

Abstract: This paper focuses on the Dutch state reformatory for girls as a site of knowledge production, concentrating on the

practice of anthropometry. The reformatory was concerned with the re-education of “delinquent“ girls. Most inmates – mainly working-class teenage girls – were admitted for what was considered sexual misbehaviour. During the observation period following admission, different knowledge techniques were employed in order to determine how to classify the inmates and decide on their treatment. Between 1905 and 1952, all inmates underwent an obligatory physical examination. The doctor recorded the results on a form containing 62 largely anthropometric questions. This paper examines the practices by means of which this knowledge was produced, tracing which techniques were used, what knowledge was fabricated, what was done with this knowledge, and what inmates had to do and undergo in order to become “legible“. Specific attention is paid to the vast amount of knowledge produced about the girls by the physician, who frequently recorded more than was asked. While histories of anthropometry often point out its declining use from the 1910s, in this state institution, the practice continued into the 1950s. This can be understood by viewing the reformatory as a scientific workshop, in which the physician was not only focused on assessing individual inmates, but also on amassing data for future publications on “the“ teenage girl. Concentrating on the “paper technology” (Hess & Mendelssohn 2010) involved in his recording practices, the double nature of anthropometry as both an individualizing and a collectivizing practice is examined.

Author: Julia Bursten

Title: Boundary Work: Nanoscience Meets Philosophy at Material Surfaces

Abstract: Nanoscience is an inherently interdisciplinary field of study. Because it developed around a scale, rather than a set of laws or phenomena, it invites research programs from fields as diverse as materials science, biology, physics, chemistry, engineering, and design. For instance, gold nano-cubes are synthesized and characterized by chemists and physicists; modeled on computers by mechanical engineers; studied for their color-changing properties in stained glass by art historians, designers, and materials scientists; and manipulated for smarter drug delivery by chemists and biologists. This scale-centric character of nanoscience means that knowledge in nanoscience is often grouped not along disciplinary lines, but rather around instrumentation techniques (as Mody (2011) has argued), around individual materials, as described above, or around particular applications. Consequently, the structure of knowledge in nanoscience is better understood as clusters of Galisonian “trading zones,” rather than a taxonomy of laws, theories, models, and heuristics. These trading zones permit contributions from diverse research perspectives—including those from history and philosophy of science. I have spent over 2 years working with a nanoscience laboratory with the aim of understanding the structure of knowledge in nanoscience. Through this work I have become convinced that philosophers and historians of science can impact the development of new knowledge in nanoscience alongside practitioners in STEM fields. My talk shows how contributions from history and philosophy of science can provide new knowledge in nanoscience by describing how philosophical reflection on the concept “surface” led to reforms in experiment design in my lab.

Author: Kele Cable

Title: The Styles of Early Experimental Evolution

Abstract: As biologists transformed evolutionary biology into an experimental science in the early 20th century, they tackled a problem inherited from Charles Darwin himself: what is the role of the environment in evolutionary change? Experimental evolutionists employed a variety of materials and methods to answer the question, but arrived at opposing conclusions. Neo-Lamarckians found their belief in adaptive variation justified by transplantation experiments with plants as experimental organisms, while those working in experimental heredity developed the pure line theory, removing the environment’s ability to generate any inheritable variation whatsoever, making use of a plethora of organisms. Other biologists adopted a more moderate stance, inducing variations and mutations via solution injections or radiation. My poster will examine these differing styles of experimental evolution, explain how the results led to varying conclusions regarding the environment, and briefly analyze the importance of the type of organism a scientist used to their methodologies and their conclusions. A poster will be an optimal method of presenting my material due to the medium’s primarily visual nature. Experiments can be well-illustrated through proper visual material paired with concise explanatory text.

Author: Ronald Calinger

Title: Euler: Return to St. Petersburg

Abstract: Euler went back to St. Petersburg from Berlin in 1766 and spent his final years there to 1783. Catherine the Great worked directly to obtain his services. He labored to restore the reputation of the Petersburg Imperial Academy of Sciences, hampered by its problematic noble directors. Working with a small research circle, for Euler this was a time of “prodigious achievement” despite essentially blindness. He now wrote or dictated more than 50% of his books and articles, numbering 415. I argue that Euler, not Lagrange, invented the analytical version of the calculus of variations. Euler now also developed

his second ships' theory and the most precise lunar theory of the century. In pure mathematics, he continued to stress and make advances in calculus and number theory. Euler also investigated new technologies, particularly with Ivan Kulibin the design of non-wooden bridges to cross the Neva. This paper corrects the general account of Euler's relations with Diderot, and it closes with Euler's accompanying Princess Dashkova to be the director of the Petersburg Imperial Academy and his election to the new American Academy of Arts and Sciences.

Author: Paul Callomon

Title: Japanese Malacology 1790-1925: Zoology in the Non-Alphabetic Realm

Abstract: Japanese zoology evolved more or less independently during the 220-year period of national seclusion that began in the 1630s. In the 18th and early 19th centuries, a thriving publishing industry and growing public interest in natural products yielded numerous illustrated encyclopedias and regional guidebooks. These in turn built on an older tradition of medicinal manuals that began in the eighth century. The vernacular names used in Japanese zoology acquired their current meanings through a reiterative process of linkage with hand-drawn figures of varying sophistication. While some vernacular names have been reliably associated with known taxa from early in their lifespans, many did not stabilize around a single organism until the late nineteenth or early twentieth century. In this presentation, I trace the paths taken by certain Japanese mollusk names from their origins many hundreds of years ago up to the present day, showing how they evolved together with the Japanese language. A broader overview of the Japanese vernacular system before and after the scientific reforms of the 1870s shows how it has not only held its own against the Western (Latin) scheme of nomenclature but is thriving today as never before. I explore the ever-present border between the two linguistic spheres and its effects on formal and informal research. Parallels are drawn with the vernacular systems of other non-alphabetical cultures such as China and India.

Author: Lino Camprubí and Samuel Robinson

Title: A Chokepoint of Oceanography: Cold War Surveillance and the Contested Sovereignty of Gibraltar

Abstract: When Cold War military strategy shifted towards submarine warfare, the surveillance of ocean chokepoints became a defense priority for Western powers. Various national and international agencies sought to obtain the oceanographic knowledge required for surveillance to be effective. The Strait of Gibraltar was one of the principal gateways into the Atlantic both commercially and militarily. This paper investigates a variety of research programs in the Strait of Gibraltar and the diplomatic entanglements built around them, including competing surveillance technologies, fractures within the Western alliance, and the links between sovereignty and control. As British and Spanish historians with access to a variety of national sources, we argue for a transnational history of the Cold War interdependence between geophysics and geopolitics in the Mediterranean. In Gibraltar, alliances and animosities were built around surveillance. The specific defense challenges posed by the control of the Strait highlight the Rock's geostrategic importance. These same challenges illuminate the role of oceanography as both an operational and a diplomatic asset. Military defense needs brought together sovereignty disputes with oceanography and the Strait became a place to develop new research programs, experimental systems, and cooperation schemes. Global models of current dynamics and temperature shifts emerged in the process. In short, surveillance turned Gibraltar into a chokepoint of Cold War oceanography.

Author: Jimena Canales and Markus Krajewski

Title: Precisely. Differentiating Accuracy, Precision, and Exactitude in the Sciences and Humanities

Abstract: In response to the question of where the "precision" of the natural sciences actually lies, a physicist or mathematician could refer quite obviously to the iron-clad laws of nature, the unquestionable truth values of his formulas, or to his experiments' methods of measurement, statistically revised, if need be. In keeping with the combination of theory and experimental verification, a notion of exactitude develops, supported in particular by 19th century metrology and its perfected system of precision measurement, which has contributed significantly to the modern dominance of the so-called hard sciences. As "natural" as it is that this foundation is now part of the self-conception of the exact sciences, as little as it is normally scrutinized, it nevertheless serves as a viable basis for countless research routines. While the premise of exactitude often seems limited to the classical natural sciences, similar concepts of (maximum) exactitude also emerge in the humanities, especially in the 19th century. For just as remarkable as the triumph of the attribute exact in the natural sciences are the simultaneous efforts of the (at least formally) "non-exact" sciences, which, like their antipodes, (wanted to) elevate the term precision (much like objectivity) to the status of a guiding principle, for instance, in philology. In our co-authored paper we will try to differentiate three different concepts, – accuracy, precision, and exactitude – by entering into a dialogue between two perspectives, from a physicist's and a historian's point of view.

Author: Guido Caniglia

Title: Mathematics and Natural Observations at the Origins of Sociobiology. The Epistemology of Hamilton's Work on Tropical Social Wasps (1963-1968)

Abstract: W.D. Hamilton's The Genetical Evolution of Social Behavior I/II published in 1964 are the two founding papers of Sociobiology. In these works, Hamilton famously exposed his theory of Inclusive Fitness about the origins of altruistic behavior. In recent years, historians and philosophers have focused on the theoretical significance of Inclusive Fitness as well as on Hamilton's theoretical/mathematical approach to social evolution. However, before and right after the 1964 publications, during some long trips to Brazil, Hamilton engaged in extensive naturalistic observations as well as in experimental manipulations of insect colonies, especially wasps. Existing narratives assume that Hamilton was just trying to test his theoretical results. In my paper, I ask: is this true? What do the data he collected in his naturalistic and experimental observations bear upon his theory of inclusive fitness? And, what does this tell us about the origins of Sociobiology and Behavioral Ecology more generally? In my talk, I question the assumption that Hamilton, in his 'naturalistic meanderings' was just trying to test his theory. I look into Hamilton's Notebooks, his memoirs and his correspondence with important naturalists of the time and argue that Hamilton actually aimed to reconstruct the evolutionary pathway that took solitary species to cross the threshold of sociality. I show that Hamilton's approach lies at the intersection of many disciplinary fields and integrates different approaches in the reconstruction of social evolution. His integrative approach can be exemplar even today in the age of molecular and systems biology.

Author: J. Cecilia Cárdenas-Navia

Title: "Hue-man" Nature: Migration, Genetics, and Alternate Evolutionary Frameworks in Post-WWII America

Abstract: Debates over human difference have long animated and troubled the realms of molecular biology and scientific practice in the United States. Studies of skin color, or melanin sciences, blossomed in the 1950s onward, specifically aided by the rise of modern genetics and related technological advancements. The cellular expression of melanin, the primary pigmentation agent found in skin, hair, and eyes, helped to frame human origins and evolution against a turbulent sociopolitical background. This paper analyzes the linkages among melanin, its adaptive properties to UV radiation, and the stakes of knowledge production in the human sciences. As innovations in GIS mapping furthered studies of vitamin D synthesis, migratory patterns, and outlier populations, molecular biologists identified different genes responsible for skin color variance across populations. Although a "race" lexis permeated these studies and limited scientific inquiry by reifying social – rather than scientific – divisions, two forums investigated melanin to divergent ends: animal studies and Creation museums. I demonstrate how zebra fish, pigeons, and albino gorillas became ciphers for culture-free exemplars of human behavior, simultaneously highlighting aggressive tendencies and survival mechanisms. Proponents of scientific creationism, long a battleground for religious zealotry and anti-evolutionary rhetoric, built museums that not only proposed alternate frameworks for human difference, but also offered seemingly more progressive visions of inclusion across color lines. By examining the conflicting narratives of these surprising antagonists and peculiar allies, I argue that greater societal and scientific advancement on questions of human equality and difference remained mired in sociocultural commitments and tragic histories.

Author: Chrystal Carpenter

Title: From Private to Public: The Acquisition, Preservation, and Availability of Archival Materials from the Norman Collection of Molecular Biology

Abstract: This poster will examine the privately collected archival papers commonly known as the Norman Collection on the history of molecular biology that are now publicly available to researchers at the J. Craig Venter Institute. During the period from 1998 to 2001, private collector Jeremy Norman amassed a vast collection of primary sources from the founders of the burgeoning field of molecular biology such as Sydney Brenner, Francis Crick, Max Delbruck, Rosalind Franklin, Sven Furberg, Aaron Klug, Max Perutz, James Watson, and Maurice Wilkins. In 2005, after much public outcry that the papers be made publicly available to scholars, the not-for-profit J. Craig Venter Institute acquired the collection. Since that time the collection has undergone extensive archival preservation, description, and digitization in support of increasing access of the collection to scholars around the world. The trajectory of the collection will be discussed alongside significant textual documentation to highlight its unique history as well as the significant historical records contained within.

Author: Brian Casey

Title: The Biological Revolution in Psychiatry: A Purely Logical Choice?

Abstract: Psychiatry has gone biological. Increasingly, mental health professionals place their faith in genetics, pharmacology, and brain science. Biomarkers have replaced psychodynamic theories. This talk argues that this shift occurred not simply because science logically pointed the way but because a prime funder of mental health research, the National Institute of Mental Health, onetime home to a wide array of methodologies, chose for a multitude of reasons to back the physiological approach to mental illness. Alongside biological psychiatry's trumpeted successes of symptom management and brain discoveries, however, there have been notable failures such as severe medicinal side effects and abandoned molecular models of mental illness. Through all of these setbacks, NIMH continued to bolster the mainstay disciplines of the biological revolution. This talk will explore some of the extra-scientific reasons for NIMH's preference. NIMH's choice to back the biological approach has had both practical and philosophical consequences. By securing the "medical model of mental illness," NIMH sought to demonstrate that mental illness is a physiological ailment in need of expert handling. In the process, in spite of an inclusive rhetoric, NIMH has effectively demoted psychosocial factors to contributing conditions. By advancing and broadcasting a biological understanding of mind (via publications, radio spots, television programs, and more recently websites and podcasts), NIMH has helped shape the modern understanding of the self.

Author: Xan Chacko

Title: Protective Pictures: The Role of the Image in the Plant Patents

Abstract: The patenting of biological material attempts to fix or capture a moment in what has been understood evolutionarily as a long continuous process of change. As the first instance of such fixation, the Plant Patent Act of 1930 guaranteed the intellectual protection of new asexually reproduced plants and heavily relied on visual representations to demarcate novelty and ingenuity. While patent applications need to show both 'novelty' and the 'inventive step' to be granted, breeders could not explain mechanistically the process of producing the novelty they sought to protect. In this paper, I claim that the ability to graft, propagate, and thereby retain the salient novel features of the plant stood in for the inventive step, since, as asexual organisms, these plants required botanical intervention to persist. Consequently, the human expertise is rendered an inextricable portion of the patent itself. I argue that the images of the plants provided proof of their uniqueness, thereby ensuring their patentability based purely on novelty, since the inventive step is a taken-for-granted aspect of their asexuality. By analysing the visualisations used in the early plant patents, especially those granted to breeder, Luther Burbank (1848-1926), and by tracking the changes in the patent illustration with respect to their accompanying text, I ask: How do patent visuals fit into the longer history of representation in scientific practice? What claims to scientific knowledge do these images try to make?

Author: Anwesha Chakraborty and Federico Nanni

Title: Changing Facets of Digital Pre-face of Science Museums: Three Case Studies

Abstract: Museums are increasingly operating in a competitive environment where they have to constantly evolve new ways to engage the attention of people showered with a surplus of cultural information. Websites are effective for this purpose because in a given physical space the number of activities one can put together is limited as opposed to the virtual world. If museums reflect the intellectual and social order of their time (Bennett 2005), then, we argue, their websites must do so even more effectively, because that is the first point of recognition of the 'personality' of the museum for many visitors. What we propose to do with this paper is to carry out a diachronic study of how science museums narrate their activities and histories through their websites. To do so we will analyse snapshots from the Internet Archive, the most important and widespread web archive. In doing so, we will obviously consider the historical reliability of re-born digital sources (Brügger 2012). We have selected the digital platforms of three different kinds of science museums for our purpose to have a comprehensive view of how they have developed their public image in the last two decades. These include the Deutsches Museum, Munich whose focus lies heavily on research; the California Academy of Science, which makes the most efficient use of social media and the National Council of Science Museums, India, which establishes itself as a platform for education, communication and promotion of science.

Author: Animesh Chatterjee

Title: New Wine in New Bottles: Technical Education and the Marketing of Electricity in India, 1900-1915.

Abstract: With the start of the Swadeshi Movement at the turn of the twentieth century, certain sections of the Indian nationalist movement resisted the introduction of Western tools, technologies and knowledge. It was in this period of heightened conflict between the ideologies of British colonialism and Indian nationalism that the electrification of India began. British electrical engineers, as a result, needed new methods to make Indians culturally accept electricity as part of their domestic lives. This paper studies the role and significance of technical education, especially of electrical engineering courses, in the efforts to sell a futuristic vision of modernity through the use of electricity in Indian homes and towns. In the social and political context of colonial India, technical education was an activity which had long been associated with the creation of an educated Indian middle class and as a tool for British political domination. However, on examination of the academic texts and lectures of British electrical engineers it can be argued that technical education was also used as a propaganda campaign to convince Indian engineering students - and a wider Indian audience through the students - about the advantages of electricity in Indian homes. This paper will draw out some of the wider implications of the content and intent of electrical engineering education, and bring to light newer aspects of the history of colonial technology transfer, technical education and the history of technology in colonial India.

Author: Sakura Christmas

Title: Evolutionary Ecology and the Transwar: Japanese Expeditions from Mongolia to Mahale, 1938-1958

Abstract: In the final years of the Japanese empire, the naturalist Imanishi Kinji set out explain the evolutionary ecology of hunters and herders in Inner Mongolia, but only began publishing those results in the 1950s. This talk traces the development of his theories on nomadism in the shifting contexts of an empire at war to a nation at peace, examining how Imanishi mobilized science for both. From the privileged perspective of aerial photographs, Imanishi saw the source of nomadic obsolescence lying in the all-too-perfect workings of a matured ecosystem. Inspired by the interconnected universe of Nishida Kitarō and the Kyoto School, Imanishi staged nomadic history in grand ecological design: each organism was an inextricable part of what he called the “species society,” evolving in symbiotic form. While the conditions of empire made his expeditions possible, the political freedoms of the postwar allowed for Imanishi to critique the very militarist structures that funded and supported his fieldwork. His expedition records reveal the deep conflict of Japanese scientists both serving and co-opting an ultranationalist state. In the 1950s, Imanishi recast his formative experience in imperial science as a universal attempt to discover the origins of human society. He used his research in Inner Mongolia to recede further back into deep time by observing gorillas in what is now Uganda. This quest for a cooperative theory of evolutionary ecology, then, represents the continuities and disjunctures, the consistencies and contradictions of Japan’s transwar period.

Author: Amy Cislo

Title: Sex Differentiation in the Later Works of Paracelsus as Precursors to Psychological Theories of Sexuality and Gender

Abstract: Recent scholarship on the history of psychological theories of normative gender and sexuality tend to focus on the works of Richard von Krafft-Ebing (1840-1902), Magnus Hirschfeld (1868-1935) and Harry Benjamin (1885-1986) to understand how the field of psychology established criteria to understand the concept of gender identity disorder, known today as gender dysphoria (Meyerowitz 2002, Stryker 2008). Not included in the recent histories of gender identity is Carl Gustav Jung’s *Psychologie und Alchemie* (1944) in which he presented an account of what he called the “psychic nature of the alchemical work”. In his book, Jung devoted considerable attention to Paracelsus. While historians of chemistry have found fault with Jung’s understanding of alchemical practice, it is still worthwhile to consider Jung’s assessment of alchemical theory. Histories of transgender identity have overlooked Jung’s role as an interpreter of alchemical tradition, especially Paracelsus. Paracelsus understood human maleness and femaleness in terms conditioned by alchemical concepts. All bodies had both male and female within them but only one characteristic tended to be revealed. Paracelsus also recognized a difference between the material body and the spiritual body. This sense of the person as two selves aided the development of psychology. My paper will compare how Paracelsus envisioned the relationship between self and body to the theories of Krafft-Ebing, Hirschfeld and Benjamin to consider the possible influence of alchemy on early psychological theories of abnormal sexuality and gender.

Author: Gene Cittadino

Title: Paul Sears and Barry Commoner on Project Chariot: Struggle for the Soul of Ecology

Abstract: Field botanist, ecologist, and conservationist Paul Sears, best known for his Dust Bowl classic *Deserts on the March*, and Washington University plant physiologist Barry Commoner, not yet the popular environmental activist, had very different responses to the Atomic Energy Commission's Project Chariot, its plan, hatched in the late 1950s, to use hydrogen bombs to excavate a harbor on the northwest coast of Alaska. Sears, then serving on the AEC's Plowshare Advisory Committee with the likes of Willard Libby and World War II hero Jimmy Doolittle, and well aware of the AEC's role in funding and promoting ecosystem research, set aside his concerns about potential harmful effects to the local residents and wildlife and tacitly approved the project. Commoner, stunned to learn the pathways by which radioactive fallout tracks through and accumulates in plants, animals, and people in the arctic environment, vehemently opposed the project and took credit for its eventual dismissal. He later stated that Project Chariot was a major factor in his transformation from a citizen-scientist concerned mainly with the dangers of radiation and fallout from nuclear tests into an environmentalist. Both Sears and Commoner had been active in efforts within the American Association for the Advancement of Science to bring public attention to issues related to the social responsibility of science. Their very different reactions to Project Chariot not only reveal generational and ideological differences but also shed light on the complex relationship between the life sciences, the federal government, and the military-industrial-university complex during the Cold War.

Author: Kathleen Clark

Title: Deciphering Mathematical Problems of the "Shoebox Collection" of the Paul A.M. Dirac Papers at Florida State University

Abstract: The Special Collections and Archives Division of the Florida State University Libraries now owns the complete papers of Paul Dirac, who was a faculty member at FSU from 1972 until his death in 1984. We are currently collaborating with with Special Collections and Archives on the digitization and preservation of an important subset of the broader Dirac Collection, known as the "Shoebox Collection." Whereas those familiar with his work would readily connect Dirac to his famous equation or his shared Nobel Prize with Schrödinger, we approached the collection with an eye on the lookout for mathematical calculations that are considered more pure in nature. The first investigation focused on identifying pages that contain evidence of solving algebraic (polynomial) equations of degree $n \geq 2$, which Dirac appears to be dealing with systematically on numerous pages of re-purposed paper. We had three goals for our project. First, we reconstructed the initial evidence found in the collection to describe Dirac's process and general solution of polynomial equations of increasing degree. Second, we compared Dirac's work with the processes and solutions known to be the subject of mathematical training at Cambridge and the University of Bristol when Dirac was a student there. Finally, we sought to highlight the pure mathematical gems that will be available as part of the Florida State University Digital Library (FSUDL), which is a publicly available and searchable database of collections.

Author: Peter Collopy

Title: Bergsonian Science: Creative Evolution in the Twentieth Century

Abstract: In 1907, philosopher Henri Bergson published *Creative Evolution*, a book in which he argued that evolution was driven by an *élan vital*, or vital impulse, responsible for both the origin of life and its increasing complexity. In contrast to natural selection, Lamarckian use-inheritance, and other mechanistic processes operating on individuals, such a force would unite all life into a single creative whole.

Among the working scientists influenced by Bergson's work were geneticists Sewall Wright and Theodosius Dobzhansky, paleontologist Pierre Teilhard de Chardin, and neurophysiologist Warren McCulloch. For the more mystically and psychologically inclined of these men, as well as for media theorist Marshall McLuhan, Bergson offered a way to understand consciousness as a plenum in which humans participated, and technology as an expression of collective creativity and a medium of evolution. These Bergsonians stood in a scientific tradition in which, as John Tresch writes, "the process of our species' evolution is externalized and socialized; we adapt as a collective by means of our tools." This tradition also included playwright George Bernard Shaw, novelist Aldous Huxley, and anthropologist Gregory Bateson, each of whom was enrolled through novelist Samuel Butler's evolutionary essays.

Teilhard, McLuhan, and Bateson became intellectual touchstones for the counterculture of the 1960s and 1970s, contributing to a cultural renaissance of Bergsonism. The idea of evolving collectively toward higher states of consciousness with the aid of technology became foundational to countercultural phenomena such as psychedelia, experimental video, and New Age mysticism.

Author: Erik Conway

Title: Engineering as the Driver of Technoscience: Or, Tilting at Windmills in Mars Exploration

Abstract: Ever since the 1976 landings of the two U.S. Viking landers on Mars, American planetary scientists have called for sample return. Quite literally, they want to bring bits of Mars back to Earth. But not just any old bits. Like more Earthly geologists, they want the ability to pick the bits that get brought back, and here is where their scientific dreams have kept running aground. This demand for choice requires mobility; in turn, mobility sparks complexity. The cost of a spacecraft is directly linked to complexity, and the several Mars Sample Return missions proposed within NASA have repeatedly soared well beyond what the agency could afford. The Mars Science Laboratory, currently operating on Mars, was supposed to be the precursor to a Sample Return mission during this decade, but like several predecessors, this sample return effort was cancelled due to funding. Yet Mars Sample Return remains the top priority for planetary scientists, as expressed by the National Academy of Sciences. Why? What drives scientists to continue advocating for such a high-risk, high-cost enterprise, across decades, when alternative exploration programs exist? In my forthcoming history of Mars exploration, I argue that planetary scientists have internalized engineers' desire to pursue technological novelty. A Mars program organized like the 1960s era Surveyor program of lunar landers--a series of identical landers sent to explore the Moon's varied terrains—is now almost inconceivable. Instead, each mission to Mars must not only break new scientific ground, it must also demonstrate new technological capacity.

Author: Tabea Cornel

Title: Human Adult Neurogendering: Brain Plasticity and Sex Difference Research

Abstract: This paper analyses the extent to which the research on adult neurogenesis in the 20th century related to neuroscientific investigations into sex differences. In the late 19th century, the influential work of Santiago Ramón y Cajal on neuronal brain organization led to an adoption of the view of a static adult brain. This principle shaped neuroscientific theories for the next century: although neuroscientists adopted the concept of synaptic plasticity towards the middle of the 20th century, the idea of human adult neurogenesis became a neuroscientific fact only around the turn of the 21st century. In the 1980s and 1990s, several attempted as well as finally accepted proofs of this form of structural plasticity were obtained in the context of sex difference research, but this important detail seems to be forgotten. Most of the subsequent studies on functional or structural differences between female and male brains asserted their congenital nature. Focusing on the late 20th century, this paper will analyze the extent to which the concept of adult neurogenesis was stripped of its association with sexual dimorphism studies; it will also inquire into how, if at all, neuroscientific sex difference research tried to incorporate the concept of brain plasticity into its work: When and where did neuroscientists embrace the idea of cerebral plasticity? To what extent was the concept of innate sex differences resistant to the theory that gender might leave its material marks on initially unsexed human brains?

Author: Henry Cowles

Title: Hypothesis Bound: Trial and Error in the Nineteenth Century

Abstract: Before the nineteenth century, “trial and error” was a mathematical trick. A synonym for a famous rule in elementary arithmetic, “trial and error” emerged in eighteenth-century textbooks alongside a host of well-defined tools for solving particular problems. Starting in the Victorian period, however, it loosed its pedagogical bonds and began to appear as a psychological description of human and animal reasoning. This paper uses “trial and error” to track new ways of thinking about human creativity and its limits. The phrase “trial and error” was introduced into psychology by Alexander Bain, whose textbooks *The Senses and the Intellect* (1855) and *The Emotions and the Will* (1859) were widely read in their own time but are little remembered today. Bain, a professor of logic at the University of Aberdeen and a lifelong friend of John Stuart Mill, is seen as the last of the “British Associationists,” whose theory of compounding mental elements was soon supplanted by German physiology and the rise of evolutionary psychology. This paper argues that Bain’s work on “trial and error” complicates received versions of the history of psychology in the mid-nineteenth century. Bain used the concept of “trial and error” to link mental associationism to nervous physiology and evolutionary theory, and his efforts reveal just how close supposedly competing notions of mental life could be in the Victorian period. In the end, “trial and error” allowed psychologists like Bain to paint reasoning as both fixed and free—bounded, yet experimental.

Author: Daniele Cozzoli

Title: The Discovery of the Other in Post-war Italian science and culture: De Martino's fieldwork in Salento and Biocca's Expedition to Amazonia

Abstract: Between November 1962 and July 1963, parasitologist Ettore Biocca headed an ethno-biological expedition, which widely covered Amazonia between the Middle Rio Negro and the High Orinoco, a region inhabited by the fierce warrior people of the Yanomámi. Biocca's expedition was a coordinated effort of different scientists and different cultural institutions both in Italy and in Brazil. A biologist, an anthropologist and a psychologist also participated in it. Curare brought back was studied at the Italian Higher Institute of Health and Yanomámi chants were studied by a musicologist and a physicist in Rome. Biocca's work is compared with the fieldwork carried out by Ernesto De Martino in Salento on the Tarantism in 1959. Both expeditions involved the collaboration of scientists and humanists coming from different fields of study. This paper argues that such collaborations were made it possible by the cultural context of Italy in the 1950s and the 1960s, where the influence of Gramsci's ideas concerning intellectuals and subaltern culture was prominent. In this paper, it is argued that in the post-war years a number of Italian scholars adopted a similar pattern of understanding the "Other" they had been acquainted with for centuries, the subaltern classes of Southern Italy, to the "Other" they somehow re-discovered in South America. The effort of understanding the "Other" also entailed an interesting attempt of redefining the relationship between the "two cultures" and an attempt of understanding the role of scientists as intellectuals in the Italian society of the 1960s.

Author: Matthew Crawford

Title: Imperial Pharmacy? Felix Palacios' *Palestra Pharmaceutica* and the Circulation of *Materia Medica* in the Spanish Atlantic World

Abstract: In 1706, Felix Palacios, pharmacist at the Spanish court, published the first edition of his *Palestra Pharmaceutica*, one of the most important works of pharmacy in eighteenth-century Spain. In 1739, Palacios' work served as the basis of the *Pharmacopoeia Matritense*, the official pharmacopoeia of Spain and its empire. As a genre in the history of science and medicine, pharmacopoeias and the works that gave rise to them provide useful insight into the intersections between state power, the production of knowledge, and the commodification of nature. What was the role of these texts in imperial enterprises? On the one hand, such pharmacopoeias would seem to be tools of empire serving to impose the theories and practices of European medicine on colonial territories; on the other, they provide evidence of how therapeutics in Europe was the product of cross-cultural exchanges. Focusing on Palacios' text, this paper explores the extent to which the Spanish pharmacopoeia represented the imposition of medical practice from the imperial center and the extent to which it represented official sanction of the hybridization and intermixing of European and American pharmaceutical traditions. In 2004, geographer Robert Voeks coined the term "disturbance pharmacopoeia" to describe the medical practice of Amerindian shaman and healers, whose therapeutic practices reflect centuries of intermixing of indigenous and European medicine. This paper will also consider the extent to which panish pharmaceutical texts might be understood as "disturbance pharmacopoeia" resulting from the cross-cultural interactions that pervaded the early modern Atlantic World.

Author: Nathan Crowe

Title: Joshua Lederberg's "Euphenics": The Construction of Human Cloning Narratives in the 1960s

Abstract: Though they are closely associated today, nuclear transplantation has not always been connected in the popular imagination to the potential application of human cloning. Robert Briggs and Thomas King developed the technique in the early 1950s at a U.S. cancer research facility, and it was not until over a decade later that outside actors began to publicly discuss nuclear transplantation's potential use in human reproduction, thus linking it to cloning. One of these individuals was Nobel Prize winner Joshua Lederberg (who actually referred to cloning as "vegetative reproduction"). In the 1960s, Lederberg became enamoured with the potential of the "new biology" and how it could affect future generations. More specifically, Lederberg imagined a biologically directed future that supposedly avoided the past problems of eugenics by focusing on genetic and cellular modifications at the developmental stage. He called this directed process "euphenics," and wrote a series of articles for the broader scientific community and for the general public about how intervention during development, through processes such as nuclear transplantation, would have profound consequences for human society. This paper will explore the evolution of Lederberg's conception of euphenics, his reconceptualization the potential of nuclear transplantation as a way to clone humans, and the subsequent backlash from the burgeoning community of bioethicists. In general, this historical episode articulates how public conceptions of science can be constructed outside the laboratory as actors deploy the scientific ideas in new ways and in different arenas, creating new narratives surrounding the science that can persist for decades.

Author: Alex Csiszar

Title: The Referee, or the Appearance and Disappearance of a Scientific Reader

Abstract: Beginning in 1831, in the midst of passionate reform movements in both English science and political culture more generally, the Royal Society implemented a series of changes that gave new prominence to men of science as readers. It re-imagined its library as a place of scientific work, exchanging non-scientific matter for more specialized books and initiating an ambitious catalogue, it began publishing proceedings, and it installed a formal system of refereeing. Adapted from the French Academy's practice of commissioning public reports on manuscripts, William Whewell's hope was that public -- indeed published -- reports by leading men of science would bring greater exposure and legitimacy to young authors, the Royal Society, and the British scientific community in general. But the production of the test-case, a report he wrote with John William Lubbock on a paper by George Airy, exposed serious doubts and disagreements about the epistemological function and identity of this new scientific personage. While the system survived, the referee was soon profoundly transformed. Just as scientific authorship was gaining new prominence as a marker of scientific activity, this new powerful scientific reader quickly became anonymous. This paper will argue that this new personage, far from being an obvious solution to a problem of scientific trust internal to the science, was an assemblage of varied and even contradictory elements, including the legal expert, the trustworthy gentleman, the state bureaucrat, and the anonymous periodical reviewer.

Author: Helen Anne Curry

Title: Endangered Maize: Agricultural Modernization and Genetic Conservation, 1935-1975

Abstract: In the 1930s American agriculturists began to fret about a novel threat posed to economic crops such as corn, wheat, and barley: the loss or extinction of genetically diverse varieties. As improved types, often inbred and increasingly hybrid, became more widely used, they tended to replace more heterogeneous varieties. If through neglect the latter disappeared, then breeders might be deprived of the potentially useful or even essential traits their genes might have conferred. Concerns about the loss of genetic diversity in agricultural plants grew stronger with passing decades, as reliance on commercial types became the global norm and as breeding techniques and agricultural markets spurred the production of ever-more uniform crops. By the 1970s, agriculturalists fretted as much about the increased vulnerability of their vigorous, high-yielding, commercial inbred hybrids in a world with decreased 'genetic resources' as they did about disappearance of so-called indigenous varieties and landraces themselves. Both could be seen as endangered. In this talk, I illustrate the history of these concerns and the global conservation efforts they inspired through the example of corn. Beginning in the 1950s, the genetic diversity of corn was the focus of intensive conservation efforts. These were driven by fears of the extinction of diverse 'indigenous' varieties and the implications of such extinction for ubiquitous commercial varieties. I link this history to that of biodiversity conservation more broadly, suggesting how a consideration of efforts to 'save from extinction' domesticated species revises a literature dominated by the history of concerns about wildlife and wildlands.

Author: Regna Darnell

Title: The Post-War Expansion of American Anthropology and its Discontents

Abstract: American anthropology during the interwar years emphasized the symbolic and expressive side of culture, placing greater reliance on linguistic texts than observed social behavior, elucidating "the native point of view" through the categories of language and the organization and content of narrative. The individual in relation to culture and history held center stage. But 1945 heralded a dramatic and rapid sea-change. This paper explores the factors that coalesced to reorient the social science landscape, from the standpoint of anthropology, into a rhetoric of revolution or discontinuity that effaced, at least temporarily, the immediately preceding history of the discipline, especially the Americanist or Boasian School associated with the study of the American Indian. The post-war critiques beg for reframing as deeply rooted in time and place, now requiring historiographic contextualization. The success of wartime technology and military/bureaucratic organization engendered a turn to the positivist, quantitative and scientific. Variables in the change included expanding universities, returning soldiers, post-war breakdown of American isolationism, area studies programs, and government funding for research. More recently the pendulum has swung back, as illustrated by reassessment of the once maligned reputation of Franz Boas. Post-war critiques have continued to be accepted without reexamination of the motives and priorities of the critics. The emerging revisionist historiography of Boas as theorist and activist reflects a much changed positioning of the contemporary anthropologist as observer of the past from that of the post-war period.

Author: Deepanwita Dasgupta

Title: The Surface of a Star, a Peripheral Scientist, and an Equation on Ionization

Abstract: This paper will try to shed some light on the social and the cognitive processes implicit in the work of someone who entered scientific practice from a peripheral situation, but eventually crafted a new and insightful solution in astrophysics. Most philosophical analysis of science remains confined to the work of analyzing a few important historical events or exploring the contributions of a few outstanding individuals. This nearly-routine emphasis focuses our attention upon only a few well-chosen contexts of science, and excludes most of the practices of a variety of self-trained newcomers. Yet, the entry of such newcomers can be seen as intrinsically interesting, for in the process of forming a trading zone with other scientific communities, they pick up a variety of mental models, establish source-target relations among them, and eventually craft some novel cognitive outcomes. To illustrate how this process occurs, I shall turn to the contexts of the 20th century colonial India, and to the episode of M.N. Saha's 1921 formulation of the Saha ionization equation. To understand the nature of ionization that goes on in the spectra of the stars, Saha modeled them as reversible chemical reactions. This creative contribution to the problem established a firm foundation for astrophysics, and provided one of the first examples of the quantum theory of light. Analysis like this points to a wider group of stakeholders in scientific creativity.

Author: Surekha Davies

Title: Cartography, Ethnology and Epistemology: World Maps as Visual Encyclopedias

Abstract: Early modern mapmakers grappled with the challenge of how to garner authority for maps of places they had not seen for themselves. Nevertheless, makers of world maps regularly trumpeted their works with such claims as 'most accurate', 'newly described' and 'most recent'. The panoptic rhetoric of maps privileged those commentators who could synthesize multiple sources and geographical, ethnographical and other discourses over individuals who had witnessed phenomena first-hand. This paper explores the ways in which Dutch world maps at the turn of the seventeenth century functioned as visual encyclopedias of human variety. By comparing them to two other visual ethnographic modes, the illustrated natural history book and the costume book, it shows how these maps drew on multiple modes in order to develop a distinctive visual epistemology for comparative ethnology. I argue that the contrasting motifs they developed for the inhabitants of different regions helped mapmakers to market their works as uniquely suited for comparing societies and the influence of environment on human bodies and temperaments. In the early modern era, maps were a key genre in which Renaissance ethnology was constituted and understood, and help us to understand important ways in which early modern science was a visual pursuit.

Author: Ronan De Calan

Title: Chemical Analysis and the Analysis of Mind: Elements for a Prehistory of Psychology

Abstract: One would surely waste his time looking for a tradition of "chemical psychology" in the second part of the nineteenth century and in the first decades of the twentieth century, the glorious years of psychology as a science. Nevertheless, chemical models have been often used in the prehistory of psychology to characterize different forms of associations, aggregations, and even fusions or composition in the realm of ideas especially at the end of the seventeenth century, when psychology was not even a neologism used to signify a part of the philosophical cursus. Those models which can be found in the works of Gassendi, Boyle, Locke, later by Condillac in the eighteenth century give use also a better understanding of what could be called "genetic empiricism": this way of empiricism that wanted to generate all the operation of the mind, starting from sensation as our basis. Contrary to what an old maxim had us believe – Nihil est in intellectu quod non prius fuerit in sensu, nothing is in the intellect which was not previously in the senses – both the concept and the word "sensation" (latin *sensatio*) entered the philosophical stage very late, in the first half of the seventeenth century. In the second part of the seventeenth century, the philosophical systems of the mind bearing on sensation were strongly articulated with what we could call a chemical interpretation of natural philosophy (1). (1) Ronan de Calan, *Généalogie de la sensation. Physique, physiologie et psychologie en Europe, de Fernel à Locke*, Paris : Honoré Champion, 2012

Author: Soraya de Chadarevian and Julia Kursell

Title: Methods and Concepts in the Loop of Exchange: Historians Investigating Life and Life Scientists Testing History

Abstract: Traditional humanities disciplines such as history or the study of the arts have often been distinguished from the

sciences on the basis of the different methods they employ. Critical and speculative methods have been associated with the humanities, and they were opposed to empirical or experimental methods in the sciences. Most commonly, the interest in a historical perspective has been referred to as what distinguishes the humanities and the sciences. The latter criterion however, does not stand up to closer examination. The ongoing debate on evolutionary theory is just one example of how the study of life and of processes of change have challenged the distinction between the humanities and the sciences. Moreover, the exchange of methods between the humanities and the sciences has sometimes led to completely new concepts in the respective disciplines. In this contribution, we look at two cases in which shared methods in the life sciences and humanistic disciplines such as history and musicology have brought about new claims about history. Introducing physiological experimentation into his study of hearing, Hermann von Helmholtz came to reformulate the history of music as a history of experimentation on hearing, thus inserting his work into a history of music (Kursell). Some historians are using genetic analysis in their historical reconstructions, thereby challenging the notion of DNA as an exclusively biological object (de Chadarevian). Both enterprises not only show how methods migrate between seemingly separate disciplines, but how this interaction affects the interpretation of history on both sides.

Author: Sybil de Clark

Title: Dimensional Analysis in the Nineteenth Century

Abstract: As mathematical relations came to involve new kinds of physical quantities, the requirements that these relations had to satisfy had to be reformulated. The emergence of modern dimensional analysis can be understood in this light, as a reformulation of the principle of homogeneity. Since Antiquity, the latter held that physical quantities, then geometric in nature, could only be added and subtracted if they had the same dimension – concept that was then intimately related to the nature of these quantities. By the early 19th century, numerical equations related physical quantities that were no longer exclusively geometric. This led to a reformulation of the principle of homogeneity, involving the redefinition of the concept of dimension: equations were required to have terms of the same dimension, but in the early 1820s Joseph Fourier identified the latter with a power relevant to perform conversions between different systems of units. To what extent this new meaning of "dimension" concurred with the former is by no means obvious, and tensions between the two notions motivated most of the debates that arose in the 19th century. However beyond these disagreements, the reformulated version of the principle of homogeneity was put to uses that its predecessor had seemingly not inspired. Lord Rayleigh's "Method of dimensions" allowed the discovery of new physical relationships, and in some instances dimensional analysis was even used to investigate the nature of physical quantities and to develop physical models.

Author: Jean De Groot

Title: The Kinematics of Leverage in Aristotle's Scientific Milieu

Abstract: A traditional question in ancient science has been whether Aristotle had a dynamics, a mathematical treatment of motion framed in terms of force or weight taken together with time and distance (Duhem, Drabkin, Carteron, Clagett, Owen, Wardy). There are in Aristotle's physical treatises passages distinctive for their use of letters to stand for varying or constant factors in movement. I contend that these passages do not share a dynamics nor is Aristotle concerned primarily with the nature of force. Drawing upon pre- and post-Aristotelian material, some anonymous and some attributed to Archytas, I present the kinematic account of leverage upon which Aristotle drew in presenting some of his covariant proportions. I focus on Physics IV.8. A new interpretation of Aristotle's account of projectile motion in that passage emerges if we consider the mathematical idea lying within his kinematics of motion—the idea of deformation maintaining an invariance across up- or down-scaling of factors that contribute to movement. Aristotle may owe this kinematic idea to mathematicians like Eudoxus. In part, though, it arose from a conceptual sublimation of experienced dynamic equilibrium. My analysis shows that there was specific mechanical knowledge already present in Aristotle's scientific environment.

Author: Eva Del Soldato

Title: Exegetical Exercises and Judaic Legends: Fortunio Liceti against Francisco Suarez

Abstract: The Ligurian Fortunio Liceti (1577-1657) was a university professor who taught in Pisa, Padua and Bologna, and is today best known for his correspondence with Galileo Galilei and his remarkably prolific output as an author. Yet Liceti probably considered that his masterwork was the *De pietate Aristotelis erga Deum et homines* (On the Piety of Aristotle towards God and men), a treatise that has been largely ignored by scholars despite its intriguing title. In this paper I will analyze the structure and the reception of this work (while its first book has a purely erudite and irenic tone, the second adopts from the start a polemical attitude). In particular, I will highlight the legend according to which Aristotle was a Jew, an idea defended by Liceti in the first book of the *De pietate* in order to present the philosopher as a monotheist; in addition, I

will examine a section of the second book in which Liceti challenges the Jesuit metaphysician Francisco Suarez's interpretation of a passage from Aristotle's *Topics* (126 a 34-36) bearing on the related — and crucial — problem of evil and divine omnipotence.

Author: Emmanuel Delille

Title: Early Psychosis Intervention in Post-War France and Germany: Historical Representations of Prevention and the Mapping of Scientific Communities

Abstract: This research project (“Psychiatric fringes – An historical and sociological investigation of early psychosis”: German Research Foundation/French National Funding Agency for Research) focuses on the scientific communities which were working to prevent mental disorders in the second half of the 20th century. It uses two techniques – a classical analysis of medical literature and a visualization software called Gephi – to reconstruct the development of the Franco-German scientific networks that evolved around the topic of early psychosis. This term refers to the initial stage of a mental disorder during which no clear symptoms have been identified and which, as a boundary of knowledge, has long posed a challenge to the field of mental health. Rather than depicting heroic portraits of individual medical careers, I would like to compare the results of the above-mentioned review of medical literature to those produced by Gephi, which provides a visual representation of scientific networks, based on digitalized bibliographic databases (such as Medline and Web of Science). Firstly, if the weakness of the French-German exchanges in the direct post-war period was followed in France by a period of rediscovery of the German works in the 1980s and 1990s, the resulting Gephi maps also reflect another socio-semantic dimension, namely the increased participation of French professors in transnational communication in English language. Secondly, mapping scientific communities points out a convergence of representations of prevention, through early intervention practices (decrease in the duration of untreated psychosis), as well as abstract data (epidemiological risk factors).

Author: Rosanna Dent

Title: Antropologia Engajada: Trajectories of Anthropological Activism in Post-War Brazil

Abstract: Dictatorship and western expansionism defined the terms of the institutionalization of Brazilian anthropology. The military regime (1964-1985) and its developmentalist agenda both imperiled and enabled the emergence of a rich national school of ethnological study. While the state-supported March-to-the-West fundamentally threatened the territory, health, and sovereignty of countless indigenous groups, generous investment in academic research and universities opened up new possibilities for anthropological graduate study and extensive fieldwork. At a moment of extreme vulnerability for many indigenous populations, scholars forayed into Brazil's interior to document and theorize the communities they visited, posing questions about the essence of humanness and human society. Their theoretical preparations drew heavily on work from abroad. But once they arrived in the field, anthropologists inevitably confronted their informants' needs and demands for social, material, and political engagement. These demands not only shaped individual research projects, they molded anthropologists' career trajectories, and ultimately defined action and activism as tenets central to the discipline. Drawing on personal papers, government documents, and oral histories, this paper argues that the political, economic, and social realities of the military dictatorship were a key factor in the development of a profoundly activist anthropology in Brazil. It examines the diverse combinations of theory and action that have emerged from contact between researchers and indigenous informants, as well as the role of indigenista activism in the professional self-imaginings of Brazilian anthropology.

Author: William Deringer

Title: Financial Bubbles and the Boundaries of Economic Rationality in the Past

Abstract: Financial crises have long served as exemplary trials of economic rationality. Many observers have cited financial panics as instances of the collective limitations of human rationality, of what Victorian chronicler Charles Mackay memorably called “extraordinary popular delusions and the madness of crowds.” Yet, at the same time, such sudden ruptures have often served to reaffirm and even strengthen belief in rational standards of economic behavior. “Bubbles”—significant deviations in price from the “intrinsic” value of an asset—are usually explained in ways that affirm a unitary, rigid view of what rational economic behavior ought to look like. Economic historians, divided on the “rationality” of a given historical bubble, nonetheless agree on what such rationality is. This paper departs from these assumptions, proposing instead a focus on the historical bounds of rational behavior. Drawing on recent attempts to model financial bubbles in terms of investor “disagreement,” it analyzes specific calculations used by sophisticated observers of the South Sea “Bubble” of 1720. A close reading of adventurous valuations from the period suggests that, in the midst of mania, what qualified as “rational” was precisely the question. By reconstructing the dimensions of plausibility that made such disagreement possible, we can see

how social contexts create variable boundaries around “rational” behavior and how such transformations can fundamentally alter subsequent standards of ethical and political action.

Author: Stephanie Dick

Title: Looking for Limits: Configuring Minds, Mathematics, and Machines in the Mid-Twentieth Century

Abstract: Herbert Simon proposed that human reasoning is limited—the mind can only manage and process so much information and must therefore contend with an always incomplete picture of the world while solving problems and making choices. His theory of “bounded rationality” is an exploration of those limitations. In this talk, I situate the theory within a broader mid-twentieth century conversation about “limitations” in mathematics and computing and other conceptions of human reasoning that emerged within it. Throughout the 1930s and 40s, mathematicians like Kurt Gödel and Alan Turing studied the limits of formal axiomatic systems. They asked questions like—what can be proved and what can’t be proved in a given logical system? Later, people like Michael Rabin and Stephen Cooke worked to mathematize and formalize the practical limitations of computers. They asked questions like—how do we measure how difficult a problem is and whether a computer will be able to solve it? And all of them asked—how much is the human mind like a formal logical system? How much is it like a computer? Is it limited in the same ways or in different ways? Simon’s theory offered one answer to these questions, but there were others. I explore the mathematical and computational tools that informed Simon’s understanding of “limitations” and the particular configuration of minds, computers, and mathematics he forged with them. I also gesture to certain different ideas about “rationality” and “limitation” that emerged from these conversations.

Author: Stephen Dilley

Title: Why History Matters in the Teaching of Evolution

Abstract: In my presentation, I use a historical lens to analyze several contemporary arguments for evolution presented in Douglas Futuyma’s widely-read textbook, *Evolution*. These arguments, which form a key part of Futuyma’s defense of evolution, depend upon historically-situated claims about what God would or would not do. Surprisingly, Futuyma seems unaware of that his theological claims often reflect a 19th century Victorian understanding of the divine. He overlooks other historically-relevant theological traditions relevant to his arguments. Still more puzzling, Futuyma’s theological claims appear to contradict other (theological) claims he makes in his textbook. In addition, Futuyma commends Jerry Coyne’s *Why Evolution is True* and Richard Dawkins’s *The Greatest Show on Earth*. These books also articulate theology-laden arguments for evolution. Unfortunately, these books contradict each other in their theological claims, perhaps because they draw upon different historically-situated theologies. I suggest that, in teaching the arguments for evolution, science educators ought to consider carefully the historically-informed theological contexts for each argument. In my view, science education would benefit from greater exposure to the history of science.

Author: Ronald Doel

Title: Science and Supranationalism

Abstract: Ronald E. Doel is Associate Professor in the Department of History at Florida State University. He has written on the history of astronomy and astrophysics, on rise of the physical environmental sciences in the twentieth century, and on scientific internationalism and scientific intelligence during the Cold War period. Recently he served as Project Leader for a 9-member, 7-national international transnational research collaboration called “Colony, Empire, Environment: An Internationally Comparative History of Twentieth Century Arctic Science,” funded through the BOREAS initiative of the European Science Foundation. Several articles he co-wrote with fellow members of this collaboration recently appeared in a special edition of the *Journal of Historical Geography*. As a contribution to this roundtable, Doel will discuss how internationally collaborative research programs emerged in the early Cold War era—and equally the political, institutional, and ideological pressures that limited transnational efforts when scientists sought to bridge the East-West divide. The physical environmental sciences are a particularly intriguing example. These fields were crucial to U.S. national security (hence, demands for secrecy)—yet geophysics was a global science demanding observations from the furthest reaches of Earth. How did researchers attempt to reconcile the competing demands of openness (the hallmark of science) and national security, where secrecy and the control of information are crucial? Two key instances will be discussed here: the design and operation of the International Geophysical Year of 1957-58 (still one of the largest international scientific activities ever undertaken) and U.S. Arctic research, involving scientists from all circumpolar nations—and more.

Author: Ronald E. Doel

Title: What We Know (and Particularly Do Not Yet Know) About Twentieth Century Interdisciplinary Science

Abstract: Interdisciplinary practices became central to twentieth century science. Yet this vital activity is remarkably under-explored by historians. There are, to be sure, important exceptions: these include analyses of the rise of astrophysics in the early twentieth century; the emergence of solar system astronomy at the intersection of geochemistry, geophysics, and atmospheric science in the pre-NASA era; and the role of the Carnegie Institution of Washington—as well as the Rockefeller Foundation’s General Education Board and International Education Board—in birthing the new fields of molecular biology and biophysics. Other works have treated the particular challenges of interdisciplinary pursuits: how is knowledge transmitted across disciplinary boundaries? How are disputes over fundamental interpretations and priority that erupt at the peripheries of established disciplines handled and resolved? How are new recruits to science trained in interdisciplinary practices? Yet a rich, detailed landscape of interdisciplinary scientific practices in the twentieth century remains elusive. This contribution will review the role of disciplines and interdisciplinary science in the historiography of recent science, focused on the North American and Arctic experience. In particular, it will focus on what we need to investigate, and interpret, before we can write a comprehensive history of twentieth century science that incorporates a satisfactorily broad range of fields, institutions, patrons, and research questions.

Author: Park Doing

Title: Technicians as Scientific Authors at a Synchrotron Radiation Laboratory from 1993 – 1999: An Alternative Expertise?

Abstract: This paper concerns interactions between technicians and scientists in a synchrotron radiation laboratory from 1993 – 1999. The laboratory under study was small but in a rapid period of growth and was making what would prove to be historic contributions to the field of x-ray protein crystallography. As a result, technicians and scientists worked closely together with a ‘start up’, entrepreneurial ethos where traditional lines between the job descriptions of the two groups, while still performed at certain times and in certain situations, were often secondary considerations compared to the importance of completing tasks, projects, and experiments at the lab. In this blurry environment, technician’s participation in, and credit for, publishable experimental work was treated informally and unevenly at the lab. While some technicians were credited as scientific authors, others who did the same kind of work were not. Given the appearance of at least some technicians on scientific papers from this time period, an unusual breach of socially demarcated lines in the field, this paper explores the epistemological implications for the content of this published scientific work.

Author: Wendy Doyon

Title: Who Puts the Work in Fieldwork? Labor and Archaeological Discovery in Egypt

Abstract: The work of scientific discovery, through the collection of artifacts and specimens to order, understand, and control the world, was part of the formation of the modern world economy and the globalization of the scientific worldview in the nineteenth century and beyond. As with other kinds of commodities in this period, the emergence of a single global market for both the objects and ideas of scientific discovery in many ways created a global division of labor between workers and explorers, and a need for intermediaries and go-betweens to broker that division. Such intermediaries can, in a sense, be seen as bridges between local, traditional ways of life around the world and our modern, global network of trade, exchange, and movement. Using the role of science in the history of globalization as a broad framework, this paper will explore how the culture and labor structure of archaeological fieldwork in Egypt have in turn structured discoveries about human history. I will begin by discussing how the development of fieldwork in Egypt has historically been contingent on factors of class, gender, age, and ethnicity. By exploring the social ties, differences, and spaces between archaeologists, archaeological foremen, and local laborers, I argue that one way fieldwork has structured the scientific record is by defining the sources that are the foci of archaeological and historical research. Finally, I will consider how the structure of archaeological fieldwork in Egypt has also shaped both the materiality and circulation of archaeological knowledge since the nineteenth century.

Author: Theodora Dryer

Title: The Housewife Problem: Applied Mathematics and Efficient Economics in the National Security State

Abstract: In the early Cold War US, increased interest in applied mathematics coincided with the shift from welfare economics to rationalized systems analysis. Narratives about new “optimal” and “efficient” methods in mathematics and economics were couched in rhetoric of wartime preparedness, peacetime planning, and applications toward the “public good.” Emblematic of this transition, this paper traces three incarnations of the same mathematical problem, from its Chicago School inception to the Pentagon, and finally to the National Bureau of Standards where it informed the first memory-stored computer. Borrowing data from George Stigler’s 1944 “diet problem,” Pentagon mathematician George B. Dantzig pursued “real world” applications for his 1947 simplex algorithm—a new tool for achieving any “objective,” from finding “minimum diet requirements” to “winning the war.” The algorithm was designed as a geometric polytope, reinforcing its veracity as a general solution for linear programming problems. Despite its visually appealing graphic form, the recasting of the diet problem as the housewife problem was widely disseminated through conferences, universities, and textbooks. Under Air Force commission, the National Bureau of Standards employed the housewife problem as part of a larger initiative programming matrix problems in development of large-scale computation machine. By the Korean War, the belief that applied mathematics could solve for the national economy was embedded in Cold War machinery. This is the story of how an algorithm traveled across disciplines, institutions, and time and how mathematicians used it to promote ideals of national security, establish applied mathematics research programs, and actualize visions of the future.

Author: Monique Dufour

Title: “The Library as Laboratory”: Bibliotherapy and the Clinical Study of Literature as Medicine, 1940-1960

Abstract: How does reading affect the mind and the body? Can these effects be harnessed as a form of medical treatment? In the mid-century United States, advocates of bibliotherapy tried to answer these questions and apply their results via “the treatment of a patient through selective reading.” Librarians, hospital administrators, physicians, and psychiatrists who interacted with patients over books extolled the therapeutic value of fiction, non-fiction, and poetry in explicitly medical discourse. However, initial enthusiasm about bibliotherapy gave rise to persistent concerns about the scientific basis for claims made for effects of reading. In this talk, I chart the mid-century rise of the “the library as laboratory” for the construction and study of the embodied reader. In particular, I examine the motives, strategies and implications of three influential studies of bibliotherapy: the Menninger Clinic studies of bibliotherapy in a neuropsychiatric hospital (1944); Bibliotherapy: A Theoretical and Clinical-Experimental Study (1950); and Veterans’ Administration studies of its national bibliotherapy hospital programs. (1944-1960). I explain the methods used by investigators to visualize and interpret how reading affected the mind and body; I also connect these attempts to the period’s broader cultural interest in understanding and managing the effects of reading, as evidenced by projects such as the Social Science Research Council reading studies. These studies, I demonstrate, simultaneously promoted and challenged scientific medicine and the normative visions of health toward which it aimed.

Author: Della Dumbaugh

Title: Creating a Life: Emil Artin in America

Abstract: Although Emil Artin did not arrive in America until 1937, the events that precipitated his departure from Germany began when Adolf Hitler and the Nazi party assumed control of Germany in January 1933. On April 7 of that year, the Nazis created the notion of “non-Aryan descent.” “It was only a question of time,” as mathematician Richard Brauer would later put it, “until Artin, with his feeling for individual freedom, his sense of justice, his abhorrence of physical violence would leave Germany.” By the time Hitler issued the edict on 26 January, 1937 removing all employees married to a Jew from their positions as of 1 July, 1937, Artin had already begun to make plans to leave Germany. On 1 October, 1937, Artin and his family arrived in New York City. Despite the concerns of key members of the American mathematical community about reaching a “saturation point” in terms of placing German mathematicians at American institutions in the 1930’s, Solomon Lefschetz worked behind the scenes to secure a position for Artin at Notre Dame. That, however, was only the beginning. From Notre Dame, Artin moved first to Indiana University and later to Princeton University. This talk will explore Artin’s time in America within the context of the larger American mathematical community at the time of his arrival and during his nearly twenty-year stay.

Author: Helena Durnova

Title: Was Václav Hlavatý (1894-1969) “Einstein’s Elementary Mathematician”?

Abstract: The Czech mathematician Václav Hlavatý started his career as a researcher in mid-1920s after a stay in Delft with the Dutch mathematician Jan Arnoldus Schouten. He devoted a significant part of his career to those areas of mathematics that are related to the search for a unified field theory, inspired by Einstein's relativity theory, working with Schouten and Dirk Jan Struik in the interwar years, and he retained his interest in unified field theory even after World War II, when he decided to stay in the US after the communist coup d'état in Czechoslovakia in February 1948. Hlavatý wrote to Einstein several times while already in the US, and although Einstein's responses were lukewarm, but there are signs that Einstein approved of Hlavatý's work and allegedly said that if someone can solve those equations, it was Professor Hlavatý. In any case, working on problems connected with Einstein's work in physics were a life-long passion for Hlavatý, as also his letters to Einstein show. In my contribution, I will show how Hlavatý's passion for problems of this kind developed from his stay in Delft in mid-1920s until a decade after Einstein's death, pointing out the inspiration of his work with physics as well as the depths of mathematical treatment of the problem.

Author: James Elwick

Title: How to Cheat on a Victorian Chemistry Exam

Abstract: Achievement examinations not only assess the knowledge of candidates; they help bestow testimonials about the possession of that knowledge. To ensure this assessment is trustworthy, much effort is put into invisible routines. Although these routines become ever more complex as exams become more standardized, it is only when they are violated that they get noticed. This paper thus studies what happened when on May 17, 1878 the highly respected science teacher Robert Goffin was caught secretly opening chemistry exams in advance and drilling his London secondary school students in the correct answers. The resulting "Goffin Affair" led to a Parliamentary Inquiry, a precedent-setting court case, and a remarkable debate in the House of Commons between Goffin's critics and allies. The documentation from this affair - particularly in testimony sometimes drawn out unwillingly, under oath – sheds light on the fraudulent assessment of knowledge and its demonstration. We learn that it is not only students who cheat on exams, but anyone who may benefit from the results.

Author: Florian Ernst

Title: Max Weber's 'Ideal Types': A Theory and its Practice

Abstract: According to Max Weber the historical and social sciences are “sciences of reality” (“Wirklichkeitswissenschaften”) that seek to explain specific and singular events, and to tell significant apart from arbitrary causal relations by forming concepts of characteristic phenomena. In order to provide these sciences with a methodologically stringent heuristics in the form of ideal types, Weber singles out the importance of a causally logical approach as opposed to a strictly ideographical one: The question “what would have been if...” should be fundamental for reconstructing single events as a part of greater causal relations, and also for identifying patterns of historical actions and developments. Weber stipulates that this requires counterfactual analyses by faking alternate scenarios based upon non-factual yet historically logical and possible events. My paper takes into account the concrete techniques of the construction of ideal types and relates them to debates among contemporary scholars about the boundaries between natural and human sciences. Weber's take on these positions marks the starting point of the discussion about ideal types: Counterfactual thought experiments are used to check idealizations which condense historical data into something significant from a specific point of view. As ever so often, these theoretical demands are accompanied by a practical method of constructing ideal types, and the paper is going to argue that Weber overcomes the classical dichotomy of ‘erklären’ vs. ‘verstehen’ in his concrete practice of forming ideal types, thus pointing out a third way that embraces pivotal elements of humanist and natural scientific methods.

Author: Eduardo Escobar

Title: Technical Knowledge and Epistemic Values in Ancient Assyrian Procedure Texts

Abstract: Assyrian technical procedures—cuneiform texts from the seventh century BC that provide detailed instructions for making kilns, glass, and medical remedies—present an untapped resource for the study of early technical language, as well as conceptual discussions of technical and alchemical knowledge. In addition to their practical content, technical procedures pair natural materials alongside incantations, they invoke demons, and, like later alchemical texts, they also include secrecy clauses. While previous studies have emphasized the practical content of technical procedures, I will argue that their aim is

ultimately linguistic: technical procedures are the products of a scribal matrix rather than windows into ancient craft. In this regard, Assyrian technical procedures intimate a distinctive scribal attitude towards technical knowledge. Indeed, rather than separating theory from practice—or in the Classical sense, episteme from techne—the corpus of technical texts includes technological knowledge among the scribal arts. For example, terms indicating experts (ummânū) or expert knowledge (nemēqu) do not distinguish between scribal and technological expertise. Furthermore, lexical evidence suggests that scribal knowledge and technical knowledge are epistemically equivalent. Methodologically, these early procedure texts may inform discussions of later intellectual traditions, including alchemical texts in particular, and, more generally, the intersection of text and practice that characterizes the creation of a technical manual.

Author: Kasper Risbjerg Eskildsen

Title: Truth without Testimony in Enlightenment Germany

Abstract: This paper investigates discussions about evidence and testimony in German historical scholarship. In recent decades, historians of science have pointed to the importance of discussions about testimony for the emergence of modern experimental and empirical natural sciences. These discussions were no less central to historical scholarship. Unlike natural scientists, historians could not produce new evidence through observation or experiment. Even if they could uncover new documents and collect information about recent events from eyewitnesses, they could not re-experience the past, and thus relied upon the words of others. During the eighteenth century, one central ambition of German historical scholarship became to limit the reliance upon testimony. Many scholars also attempted to identify sources that should not be considered as testimonies, but rather as “relics” or “leftovers” of the historical situation, such as antiquities, archaeological sites, and some types of archival documents. This transformation demanded not only the introduction of new the research practices, some of which were borrowed from the natural sciences, but also a rethinking of the role and persona of the scholar. The discussions about testimony in eighteenth-century German historical scholarship may even be considered as a precursor to nineteenth-century discussions about scientific objectivity. The paper illustrates these developments through the examples of Johann Peter von Ludewig, who was the most important representative of early Enlightenment Reichshistorie, and Johann Christoph Gatterer, who is often considered one of the founders of modern critical historical research, and especially focuses upon their use and interpretation of manuscript sources.

Author: Kay Etheridge

Title: Circulating Images and the Production of Natural Knowledge

Abstract: A 2009 exhibition at the Fitzwilliam Museum on the confluence of art and science included a plate from a 19th century German encyclopedia showing a tropical tarantula poised over a dead bird. Versions of this image appeared in numerous natural history books, magazines and other formats for more than two hundred years after its original publication in *Metamorphosis insectorum surinamensis*, a 1705 work by Maria Sibylla Merian (German, 1647-1717). The image, constructed from information received by Merian from Amerindians during her work in Surinam, will serve as a case study. Such illustrations along with descriptive text helped scholars to visualize and classify natural systems, laying the foundations for ideas on evolution and adaptation. Additionally, images such as those by Merian and other artist/naturalists were copied and reused in the numerous publications cataloging and popularizing nature that blossomed in the 19th century. This paper will examine the flow of information from the New World to Europe through the example of Merian’s work, the ways in which indigenous knowledge was shaped by mediators such as Merian, and how local sources were perceived by a European audience. The role played by various types of nature publications in the 19th century popularization of science also will be addressed.

Author: James Evans

Title: Appropriating Eratosthenes: Is Rehabilitation Still Possible?

Abstract: The reception of Eratosthenes’ measurement of the size of the Earth has been a puzzle. In popular history of science, Eratosthenes is treated as a hero of rationalism. But Eratosthenes’ calculation, as recounted by Cleomedes, seems anticlimactic. It was made a century after the earliest Earth measurements. Moreover, it is methodologically far simpler than the measurement of the sizes and distances of the Sun and Moon by Aristarchus earlier in Eratosthenes’ own century. Finally, there is the second, slightly larger value for the circumference of the Earth (252,000 stades rather than 250,000) attributed to Eratosthenes in Greek and Roman sources. Scholars have speculated that Eratosthenes made improved measurements, that the circumference was rounded to 252,000 to be divisible by 360 or by 60, or that 252,000 was mystically significant. Fragments survive of a work on “measures” by Eratosthenes, separate from his *Geography*. And doxographical writers preserve his values for the distances of the Sun and Moon. The doxographers had their own purposes—to preserve fragments

of ancient science for handy reference (as with Stobaeus), or to ridicule the science of the pagans for its ineptitude (as with Theodoret). Can we still recover Eratosthenes' program? We shall argue that Eratosthenes gave both an upper and a lower limit for the circumference of the Earth. 250,000 stades follows from the calculation preserved by Cleomedes, with the Sun at infinity. But 252,000 is Eratosthenes' upper limit for the circumference of the Earth, based on placing the Sun at a finite distance.

Author: Seb Falk

Title: Digitisation and the Vernacular: New Approaches to Medieval Scientific Instruments

Abstract: The accelerating digitisation of medieval manuscripts has hugely increased the range and accessibility of resources available to historians. But such digitisation efforts have also opened up new avenues for research, as manuscripts become increasingly searchable and online catalogues and other tools are expanded. As a case study in the potential benefits of digitization, this paper will examine *The Equatorie of the Planetis*, a unique fourteenth-century manuscript treatise (attributed by some scholars to Geoffrey Chaucer) that describes a planetary equatorium. The digitization project, recently completed for the Cambridge University Digital Library, provides not only greater accessibility via manuscript images, but also a fully searchable transcription and virtual model of the instrument described in the manuscript, allowing it to be interrogated in new ways. Similarly, the increased use of vernacular languages alongside and in place of Latin in fourteenth-century Europe was not simply about greater accessibility to laymen and women. Besides the political or theological implications, different languages offered different explanatory possibilities to authors – developing languages required new vocabulary and structures to present scientific ideas. While it is too soon to say what new historical ideas will arise from the opening up of this unique manuscript online, the project has already provided greater understanding of the linguistic choices made by the treatise's author. This paper will show how the vernacular technical terminology coined by late medieval authors helped to shape not only the English language, but also the science that was practised in that language.

Author: Nahyan Fancy

Title: Alternatives to Galenic Physiology in the Islamic World: The Evidence from the Commentary Tradition, 1200–1500 C.E

Abstract: The narrative of decline looms large over the study of medicine in post-1200 Islamic societies. Popular and scholarly accounts establish the “fact of decline” on the basis of the non-emergence of modern medical theories, such as Harvey's theory of blood circulation, in the Islamic world. They also point to the prevalence of commentaries and the disappearance of “original” works in this period as evidence for this “fact.” Pre-modern Islamic medical authors are thus depicted as primarily being concerned with treasuring, synthesizing and systematizing Galenic medicine, in contrast to the critical, “scientific” concerns of the European Renaissance authors who are depicted as surpassing it. Through close examination of Arabic medical commentaries composed on the *Canon of Medicine* and the *Epitome of the Canon* between 1200 and 1500, this paper will demonstrate that far from slavishly adhering to Galenic physiology, the commentators were charting new trajectories of non-Galenic physiologies. The paper will focus specifically on Ibn al-Nafīs's (d. 1288) non-Galenic, non-Harveian understanding of pulse, generation and nutrition proposed in his *Commentary on the Canon*, and how it was debated and modified in subsequent commentaries. The paper will thus suggest how abandoning the telos of the Scientific Revolution can help us gain a better understanding of the trajectories of medical physiology from the perspective of the pre-modern actors themselves. Such an approach also promises to engender further research into the specific networks of knowledge-exchange that led to the appropriation of some of these post-1200 trajectories and their transformation during the European Renaissance.

Author: Amy Fisher

Title: Teller vs. Pauling: The Debate over Disarmament and the Peacetime Uses of Nuclear Weapons

Abstract: In 1958, Edward Teller and Linus Pauling appeared on public television in California to debate the pros and cons of nuclear disarmament and the peacetime uses of atomic weapons. Pauling emphasized the hazards of nuclear fallout and the long-term negative effects of radiation on human health. In contrast, Teller asserted that the health effects, if any, were inconsequential compared to the political instability and conflict that would result from American disarmament, as he believed the Soviet Union was unlikely to reduce their weapons cache. Ultimately, the Teller-Pauling debate sheds light on not only the epistemological divide between the two men regarding the collection, interpretation, and significance of radiological data, but also their political beliefs. By analyzing this broadcast and placing it into its broader historical context, this paper explores how arguments about intent and use, disciplinary identity, and politics shaped their debate during this critical period in American science.

Author: Maura Flannery

Title: *Darlingtonia californica*: The History of an Iconic American Plant

Abstract: *Darlingtonia californica*, the cobra lily, is a pitcher plant that was discovered in 1841 by William D. Brackenridge, a botanist on the US Exploring Expedition (Wilkes). Brackenridge prepared pressed plants, that is herbarium specimens, of species he collected, and they were sent to the New York botanist John Torrey for identification. In the case of the cobra lily, as with many of the species coming from the expedition, Torrey realized that it was a new species. He named it after his friend and fellow-botanist William Darlington of West Chester, Pennsylvania. This plant's pitcher and its flower are both aesthetically pleasing, and its appeal is also related to its insectivorous behavior, making it a plant that has become noteworthy even though it has a limited range in nature. Beyond its biological interest, *D. californica* also makes a noteworthy case study in the politics of naming plants. Another plant that had earlier been named after Darlington was later renamed, so Darlington was nervous about this happening again when he learned that the British botanist George Bentham had published on a new pitcher plant species. Torrey wrote to ease his mind, going to the trouble of copying out the figure from the Bentham article to show that it was significantly different from *D. californica*. Other relevant Torrey-Darlington correspondence will also be presented here, revealing the intricate social network that existed among American botanists during the first half of the 19th century.

Author: Raymond Fredette

Title: Galileo Galilei: *De motu antiquiora scripta mea*

Abstract: Galileo Galilei, *De motu antiquiora scripta mea*/ My Older Writings On Motion (c.1588-c.1594). An Abandoned Work in Progress Launching a Whole Career. The young filosofo-geometra standing on the shoulders of The Philosopher

Author: Aileen Fyfe

Title: Refereeing in Action at the Philosophical Transactions, 1850-1890

Abstract: Peer review has come to be seen as central to the process of scientific knowledge-making, and its origins have been routinely traced to the Royal Society's Philosophical Transactions. The 'Publishing the Philosophical Transactions' project is investigating the commercial and editorial practices behind Phil Trans, and this paper reveals some early results. It is clear that Phil Trans has had a variety of selection practices over its history, with the concept of secret written reports by expert reviewers emerging in the 1830s. There have been small-scale studies of nineteenth-century refereeing at Phil Trans, but this paper uses the research project's resources to undertake a statistical and prosopographical analysis of refereeing at the Royal Society in the late nineteenth century. By this time, refereeing had ceased to be a novel process – although it was still not widely used outside the learned societies – and thus, did not usually attract comment. This is why the Society's 'Register of Papers' is so useful, because it shows us refereeing in normal operation over an extended period of time. As well as revealing a group of particularly active referees, this paper suggests the importance of certain Fellows acting as patrons to junior (non-FRS) authors by 'communicating' their papers to the Society. It also shows that certain types of decisions were not dependent upon referees.

Author: Joseph Gabriel

Title: The United States Pharmacopeia and Problem of Intellectual Property

Abstract: First established in 1820, the Pharmacopeia of the United States of America (USP) was intended to standardize the remarkable diversity of therapeutic knowledge in early America. Its authors labored under the assumption that medical science was a cooperative process and assumed that goods monopolized through the use of patents and other forms of intellectual property (IP) were an illegitimate form of quackery. Over the course of the next century, however, revisers of the USP faced a series of problems that challenged this framework. First, monopolized goods grew increasingly important to therapeutic practice, leading to the recognition that some patented goods would need to be included. Yet at the same time, reformers also worked to enforce pharmacopoeial standards through legal means; as a result it seemed unethical to include patented goods because it would give individual manufacturers legally enforceable monopolies over therapeutic markets. Finally, revisers of the USP recognized that standardization at the national level might not be enough to achieve their goals, and in 1902 sent representatives to Brussels to attend the first conference dedicated to establishing a "universal pharmacopeia." However, despite their initial enthusiasm for the project, the revisers of the USP were reluctant to adopt the

many of the standards agreed to at Brussels due to complex questions related to IP rights and the legal standing of the American pharmacopeia. As a result, before World War I the USP lagged behind other national pharmacopeias in conforming to the emergent international framework for drug standardization.

Author: Caitjan Gainty

Title: The “Smooth Flow” of Birth: Streamlining and the Obstetrical Oeuvre of Joseph B. DeLee, 1930-1940

Abstract: In the 1920s, a new medical achievement was celebrated: the streamlined birth. Drawing on the contemporary streamlining design trend, itself an aestheticization of the engineers’ charge to attend to the aerodynamicity and efficiency in design, the streamlined birth encapsulated the power of the streamlined aesthetic in material, medical form. Both for its emphasis on painlessness and forgetfulness in the process of childbirth and for its “smooth flow,” meant to call to mind the ideal state of biologic functions, the streamlined birth was a quintessentially modern birth experience. For its many detractors, the streamlined birth seemed yet another obvious bid by medical practitioners to position their practice as essential to the basic functioning of everyday life. This paper considers the streamlined birth as it was imagined by the obstetrician Joseph DeLee, who (re)produced the streamlined birth in scores of films in this period. DeLee’s films show a more complex relationship between natural and artificial (and medical) than we have usually imagined; they present the streamlined birth as a technological proxy that yearns for, rather than displacing, a no-longer-attainable, highly-idealized natural state. It is the modern condition, not birth itself, that is pathologized. These films also present the motion picture camera, and the highly-edited and manufactured reality it creates, as the medical tool most appropriate to the creation of new life. Here DeLee’s work, like that of his contemporaries, conjures up a medical world where aesthetic choices made on film constitute real life medical therapy.

Author: Ofer Gal

Title: Contingency in the Universe of Precision

Abstract: One of Koyré’s famous depictions of the Scientific Revolution – “From the world of the ‘more-or-less’ to the universe of precision” – has always seemed to capture both the new empiricism, with its stress on precise measurement, and the new mathematical natural philosophy, which aimed to capture the precise, simple and harmonious structures ruling heaven and earth. In fact, this paper will claim that the growing precision of instrumental observations and the developing sophistication of mathematical tools led to an abandonment of the hope to reveal a universal mathematical structure from which worldly phenomena would follow by necessity. Instead, interest was turned to contingent, independent causal processes, and contingent, isolated constants by which these phenomena were determined. I will provide three examples: from optics, terrestrial experimental mechanics and celestial theoretical mechanics.

Author: Justin Garson

Title: A “Model Schizophrenia”: Amphetamine Psychosis and the Transformation of American Psychiatry

Abstract: In 1958, the British clinician P. H. Connell coined “amphetamine psychosis” for the transitory psychotic episodes that could be induced by amphetamines. Immediately, biochemical researchers suggested that amphetamine psychosis be used as a “model schizophrenia.” In other words, might the controlled administration of amphetamines to laboratory animals and human volunteers shed light on the underlying mechanisms of schizophrenia? However, it took over a decade for researchers to systematically pursue this lead. One problem was that, in the early 1960s, clinicians were skeptical about the claim that amphetamine psychosis accurately mimicked the full spectrum of schizophrenic experience. Another problem was that LSD was already being used for that purpose. My study examines the period between 1958 and 1972 in order to answer the question: how and why did psychiatric researchers come to perceive amphetamine psychosis as a “model schizophrenia”? There were two main factors. First, in the late 1960s, researchers in Scandinavia and the United States reported that amphetamine psychosis did, in fact, mimic the full spectrum of schizophrenic symptoms, including stereotypy and thought disorder. Secondly, around the same time, the American countercultural revolution helped to transform public perception of LSD. Figures such as Timothy Leary and Allen Ginsberg, as well as journalists, artists, and sociologists, broadcast the message that while LSD merely “enhances” normal perception, speed makes one paranoid and violent. By the early 1970s, American psychiatrists freely borrowed and modulated these new meanings to argue that amphetamine psychosis should replace LSD intoxication as a model of schizophrenia.

Author: Rodolfo Garau

Title: Contingency and Laws of Nature in Descartes's Physics

Abstract: Following Aristotle's conception of contingency (*ἐνδεχόμενον*), describing natural phenomena happening for the most part (*ἐπὶ τὸ πολὺ*), Scholastic natural philosophers defined sublunary physical phenomena as being characterized by a "contingentia ut plurimum." According to this view, these phenomena are regular to a certain extent, but they do not take place necessarily. Natural entities are in fact determined by God, the author of nature, to act in a certain way or to produce a certain effect. Still, their action can be impeded, whereas that of necessary phenomena (such as the motion of celestial bodies) cannot. Through an analysis of Descartes's natural philosophy, I shall show how this Scholastic conception of "contingentia ut plurimum" influenced early formulations of inertial mechanistic physics, which was on the rise in the early modern period. In fact, the same tension between a rectilinear, inertial motive determination of bodies—which Descartes sees as a result of the divine ordinary concurrence—and the lack of a necessary actualization of this determination—which results in the curvilinear and irregular motion of bodies—characterizes the Cartesian description of nature. The complex web of mutual causal interaction between bodies—an essential characteristic of a plenistic nature—makes the rectilinear, inertial determination intrinsically contingent. The "laws of nature" for Descartes are therefore adduced to account for this state of intrinsic contingency of natural phenomena. I explore the epistemological consequences of this view on Descartes's physics.

Author: Xuan Geng

Title: Loving the Country, But not Necessarily the State: American-Trained Chinese Agricultural Scientists, 1920s-1930s

Abstract: This paper proposes a revision to the idea of "scientific nationalism," or the allegiance to the natal nation-state of scientists who then trained in other countries. Using a group of American-trained Chinese agricultural scientists as a case study, I argue that these scientists were motivated by a dual-identity of being both scientists and Chinese people, dedicated to improving life for their fellow countrymen. From their point of view, this was a cultural orientation, not a dedication to the state (the government) or to a particular ideology; it was "love for the country" (爱国) rather than nationalism as excessive "loyalty to the nation" (民族主义). Zou Bingwen, Dai Fanglan, and Shen Zonghan, all plant pathologists trained at Cornell University, chose different ways of demonstrating this dual-identity. Zou succeeded in appealing for social supports and established a Chinese education-research-extension model for agricultural education. Dai devoted himself to both pure and applied agricultural research to increase the food supply and contribute to international science. Shen became a director at the National Agricultural Bureau, believing that this was the best way to adapt agricultural research for the use of farmers. Although taking different strategies during this chaotic Republican period, the three scientists shared similar motivation and desires: to improve conditions for the Chinese people, and to improve agricultural science. Serving the state was only one of the strategies to realize their desires. By emphasizing the "dual-identity," I will revise the idea of "scientific nationalism" in the history of science in republican China.

Author: Bonnie Gidzak

Title: Explaining the Atom: Science Education for Survival in the Atomic Age, 1945-1957

Abstract: Immediately following the atomic bombing of Japan in August of 1945, the American government and journalists asserted the scientific importance of the atomic bomb and how, by unlocking the secrets of the atom, this new science fundamentally changed how humans interacted with nature. The atomic bomb and the science behind it evoked fears of worldwide nuclear war while simultaneously generating hopes for unlimited electricity and miraculous medical cures. Public attention to nuclear possibilities challenged scientists, educators, and the growing nuclear industry to explain atomic science and the implications of the new Atomic Age to the general population. With the post-World War II view that the strength of the nation relied, in part, on a generally educated public, multiple aspects of atomic science, including atomic structure, isotopes, radiation, and fission, were featured in media made accessible to a broad audience and used in formal education settings. Clearly, full details of how to build an atomic bomb could not simply be handed over to the public. Nonetheless, basic definitions of atomic science terms and atomic structure diagrams appeared in newspapers, magazines, lectures, and educational materials. This talk discusses how the atomic science information was presented and contextualized to show that these explanations were framed as a necessary preparation for life in the Atomic Age and enforced the perception that atomic science fundamentally changed how humans interacted with nature.

Author: Jordan Goodman

Title: Spot the Go-Between(s): Joseph Banks, Knowledge and Interpreters for the Macartney Embassy to China, 1792

Abstract: The Macartney Embassy was the largest attempt yet by a western European power to convince the Chinese Emperor to change his modus operandi when it came to British merchants trading in China. The ships set sail in September 1792 after nine months preparation. Joseph Banks, President of the Royal Society, had by then convinced the British Government, the East India Company and the mission's two principals, Lord George Macartney and Sir George Staunton, that what was at stake was knowledge as well as commerce. No amount of money should be spared. "In a few weeks", as he stated, "[we would] acquire Knowledge for which the Whole Revenue of the immense Empire would not be thought a sufficient Equivalent". That none of the mission's objectives would be realized without trustworthy and competent interpreters was known by all from the very beginning. But where were these interpreters, these critical go-betweens? And how could they be trusted? It fell to Joseph Banks, himself an archetypal go-between, a mediator and a connector; a man who seemed to have known everyone of any importance, whose own powers to convince ensured that others would act for him, to find these people. How Banks found the interpreters and whom he had to convince in order to turn what were non-interpreters to play the role that he had scripted for them, these are questions my paper seeks to answer. In so doing it will also contribute to the larger task of further problematizing the concept of the go-between.

Author: Kate Grauvogel

Title: The Hazards of Lying-in: Rudolf Virchow's Experimental Research on Deep Vein Blood Clotting

Abstract: Early modern and nineteenth century physicians reasoned that conditions such as "milk leg," commonly seen in puerperal women, were caused by stasis of breast milk in the leg. Because swelling and whiteness in one or both legs often presented in postpartum women, the connection between biological sex and clotting disorders was reinforced by the advent of lying-in hospitals, which facilitated the clinical observation of postpartum women. Eventually, observations and experiments by doctors such as Rudolf Virchow led to the realization that men and non-gravid women could also develop so-called "milk leg." This awareness shifted the conversation from biological sex and reproduction in women to additional factors associated with clotting, such as theories on the roles that illness and injury played in the pathogenesis of the clot. Virchow speculated that blood clots often appeared as complications or symptoms of other diseases; clots were not necessarily diseases in and of themselves. Specifically, Virchow's observations and experiments caused him to speculate on the role of secretions (in both women and men) in blood clotting. This paper will argue that Virchow's pathological experiments on clotting, in addition to the time he spent observing lying-in women at Charité Hospital in Berlin, led him to observe links between ovarian disorders and clotting. To make this argument, I will draw from early recorded cases of clotting, as well as Virchow's own writings, particularly Cellular Pathology and General Disorders of Nutrition and Blood: Diseases of the Musculoskeletal System.

Author: Christopher D Green

Title: All of Psychology in a Single Network?

Abstract: What can one discover about the intellectual structure of an entire discipline by examining a network of the vocabularies used in its scholarly journals? For the past several years we have been creating networks based on the substantive terms used in the articles of various American psychology journals from about 1880 to WWI. Thus far, we have conducted this exploration one journal at a time – American Journal of Psychology; Psychological Review; Journal of Philosophy, etc. – and in limited time blocks of 10 years each. In each of these networks, we were able to discover multiple, distinct communities of researchers who were developing "dialects" of the broader psychological "language" specially suited to sub-disciplines such as color vision, depth/distance perception, hearing/music, cognition, mental testing, philosophy/metatheory, and others. In this new presentation, however, we bring the various journals together, across the decades, into a single dynamic network that (1) shows the subdisciplinary research communities across journals and (2) that is able to move and reconfigure itself through time as the various research communities shifted positions relative to each other, split apart, merged together, or sometimes disappeared altogether. The result is a "high-altitude" view of the entire discipline though, unlike in some past large scale histories, one in which we can always to "zoom in" to the scale of a single article to test whether some broad "macro-level" conclusion is borne out by a detailed "micro-level" examination of the basic material.

Author: Monica Green

Title: When History Becomes Science: Medieval Diseases in the Twenty-First Century

Abstract: The field of History of Science normally studies the construction of science in the past. But what happens when Science becomes the driver of historical investigation, leaving historians in the dust? This has already happened in the field of disease history. The historical narratives of several pathogens have been placed decisively in evolutionary time by means of rapid advances in genomics analysis and ancient DNA (“aDNA”) technologies. Particularly ironic is that the two most emblematic “medieval” diseases, plague and leprosy, have been out in front in these twenty-first-century developments, their pathogens’ genomes being the first to be fully sequenced from pre-modern remains. But the historian still has a crucial role to play. I will explain why approaching this new historicist science from the perspective of the historian of science actually aids in creating new dialogue between the several disciplines now contributing to the field of disease history. “Pandemic Disease in the Medieval World: Rethinking the Black Death,” is an experiment in multidisciplinary collaboration that will appear Fall 2014 in the newly launched journal, *The Medieval Globe*. Drawing together historians, anthropologists, and a microbiologist, we capture an unfolding scientific narrative “in the act” to assess transformations in genetics over the last 15 years. The particular value of historicist science, I argue, is that it can push us into terrain otherwise invisible in written documents. It can create a more encompassing narrative, one that allows us to unite virtually all of Afroeurasia, and even the whole world.

Author: Josh Greenberg

Title: Opening Doors: From Graduate School to the Sloan Foundation via Zotero

Abstract: Josh Greenberg (co-founder, Zotero; Program Director, Alfred P. Sloan Foundation) will describe a set of career decisions that have led him from graduate school to the Sloan Foundation via the Center for History and New Media at George Mason and the New York Public Library. A core set of questions and issues have run through all of these jobs, and while not deliberately planned, he finds a certain coherence to his career arc to date, particularly in his current role as a funder. In his talk, he will discuss the choices that have opened doors and reflect on some of the challenges and opportunities of maintaining an identity as an active researcher outside the norms of a traditional academic job.

Author: James Grossman

Title: History at Large – A Perspective from the AHA

Abstract: James Grossman (Executive Director, American Historical Association) will survey the landscape of history Ph.D. employment, suggesting the range of occupations and settings in which individuals with History Ph.D.’s are working. This broad range is new to neither the discipline itself, nor the AHA’s membership; it has precedent in the decades before the post-WWII expansion of colleges and universities in the United States. This presentation will also describe what the AHA is currently doing to bring historians employed outside the academy back into our discipline-based community. Grossman will also speak to the importance of distinguishing between history as a discipline, and college/university teaching as a profession, if we are to think about the ways in which individuals can continue to engage history and historical thinking wherever they might be earning a living.

Author: Mathias Grote

Title: From ‘Signal Transducers’ to ‘Molecular Machines’ – Membranes and the Re-making of Life’s Materiality, c. 1970-1990

Abstract: Whereas genes and cells have received broad attention in the history of biology, another central object to the life sciences, membranes, remain largely a desideratum. For much of the 20th century, attempts to make sense of membrane activities in nerve excitation or respiration have formed streams of investigation straddling e.g. physiology, electrochemistry and biochemistry. A novel model of membrane organization, novel experimental methods and novel research objects promised to bring membrane research down the molecular dimension after 1970. Rhodopsins, known as the eye’s photoreceptors, drew much attention – for a moment, they must have appeared as the ‘phage of perception’ that Max Delbrück was looking for. Even if such high hopes were deceived, rhodopsins became a hot topic, and more generally perception or energy generation were modelled through structure and dynamics of membrane ‘transducers’ and ‘pumps’, or later on ‘molecular machines’. Following membrane research on the level of laboratory practices and models allows me to depict the entanglement of e.g. bioenergetics and sensory physiology to form a recent ‘molecular biology beyond genetics’. What is more, membrane

research also sheds new light on philosophical questions. On the basis of e.g. laboratory notebooks, I argue that practices of analyzing, modelling and re-making membranes as palpable substances have helped to materially entrench physiological processes as ‘molecular mechanisms’ – from the laboratory into biomedicine. Membrane research is an emblematic case of a ‘metabolic biology’, focusing on material transformations and boundaries of organisms. Its study will help to complement our picture of the life sciences.

Author: Walter Grunden

Title: Empowering Hungnam: The Transwar Legacy of Japanese Scientific, Technological, and Industrial Development of a Korean City

Abstract: In the 1930s through 1945, the city of Hungnam emerged as one of the most important industrial sites on the Korean peninsula as it was the locus of significant research, development, and manufacturing involving numerous chemical processes. The new zaibatsu firm, Nihon Chisso (Japan Nitrogenous Fertilizer Corp.), built several factories to produce aviation fuel and nitrogen enhanced fertilizers, among others. By the end of the war, Hungnam ranked as one of the most important cities in the Japanese empire and was a prized asset for whoever controlled it. This presentation examines Hungnam as a contested technological space in three phases: first, as the Japanese firm Chisso appropriated it for industrial development and colonial exploitation in the 1930s through 1945; secondly, as the Soviet Red Army occupied and looted it at the end of the war; and third, as United States and United Nations forces battled North Korean and Chinese armies there in December 1950. This transwar study examines the legacy of Japanese industrial development in Hungnam that survived two wars and positioned the city to become one of the most important industrial centers of North Korea today. Intertwined in this narrative is the allegation that Hungnam also served as a colonial center for Japanese nuclear research during World War II – an unsubstantiated but enduring claim – and the ironic fact that the city now serves as one of the most important sites in North Korea's nuclear energy and weapons development program.

Author: Jonathan Grunert

Title: The Lithographer as Agent of Change: J.T. Bowen and Natural History Illustration

Abstract: John T. Bowen, a Philadelphia lithographer, first gained prominence in printing scientific illustrations through his engraving work on Thomas Nuttall's 1832 *Manual of the Ornithology of the United States and of Canada, Vol. I: The Land Birds*, done under the employment of Carter and Andrews of Lancaster, Massachusetts. By 1839, he had founded his own lithography firm and had contracted with John James Audubon to produce a smaller, “Royal Octavo” edition of the renowned *Birds of America*. His praised work with Audubon, who had fallen under heavy criticism for his manner of practicing ornithology, positioned Bowen to change the styles of American ornithology. In this paper, I argue that Bowen the lithographer gave rise to new styles of drawing birds for natural history publications. This signifies a shift away from institutional and artist-naturalist influence, toward a greater influence by the artisans, i.e. engravers and lithographers, who reified imaginings of birds onto the printed page. Drawing from Lorraine Daston's discussions of scientific representation, I argue that Bowen's illustrations are in conversation with other illustrations, such as those by Alexander Wilson (who produced the first ornithology in the US), Audubon, and Nuttall, and also with institutions such as the Academy of Natural Sciences of Philadelphia. Bowen's illustrations accompany John Cassin's text for *Illustrations of the Birds of California, Texas, Oregon, British and Russian America*, along with various articles present in the *Journal of the Academy of Natural Sciences of Philadelphia*.

Author: Katja Guenther

Title: Mirror Neurons and the Human–Animal Divide

Abstract: Mirror neurons were first discovered in monkeys. Recording from electrodes implanted in the premotor cortex of the macaque monkey in the 1990s, scientists at the University of Parma found that a group of neurons fired when the monkeys were performing certain motor tasks, but also when they were not moving; the neurons were activated when the monkeys simply observed others doing the same things. Yet despite this provenance in animal studies, mirror neurons later came to be seen as a marker of what is distinctly human. Using imaging studies such as functional MRI, researchers like Bruno Wicker have taken mirror neurons to explain emotional empathy—certain brain regions were found to be active both when people experienced an emotion themselves and when they saw another person experiencing it. Mirror neurons have also been used in explaining autism (e.g. by Marco Iacoboni); a distinctly human ability of self-awareness (L. Oberman & V.S. Ramachandran); and for some they were even the “driving force behind the great leap forward in human evolution” (V.S. Ramachandran). This paper examines the relationship between mirror neurons and the human-animal divide, working

out how different experimental protocols and techniques helped re-inscribe lines between animal and human subjects that the phenomenon of mirror neurons seemed to efface.

Author: Chad Gunnoe

Title: Toxites as Paracelsian Advocate

Abstract: While Allen Debus did much to illuminate the work of English and French Paracelsians, and in so doing gained recognition for the “chemical philosophy” in the historiography of the scientific revolution, many decades later much about the German Paracelsians remains obscure. This paper addresses this gap by offering an overview of the role of Michael Toxites in the movement. Toxites was a moderately successful poet and humanist pedagogue of the Strasbourg school. After the double humiliation of losing his position as a schoolmaster in Württemberg and later being released from his arts faculty position in Tübingen, he enjoyed a successful second career as an entrepreneurial Paracelsian physician and propagandist. Alongside Adam von Bodenstein and Gerhard Dorn, Toxites was one of the chief publishers of Spagyric texts in late sixteenth century Paracelsian revival. The paper will offer a brief overview of his career with particular focus on his role as editor and interpreter of the religio-scientific texts of Paracelsus including the *Astronomia Magna* oder *Philosophia Sagax*. Toxites’ dictionary of Paracelsian vocabulary (*Onomastica II*) will also be addressed. Toxites’s impact was multifaceted: he furthered the turn of Paracelsianism toward Hermeticism; he advanced the use of chemical preparations of such as antimony; and he sought to make Paracelsus intelligible and palatable to the learned imperial community. The paper is offered as a tribute to the recently deceased Prof. Dr. Joachim Telle, the greatest scholar of Paracelsian arcana since Karl Sudhoff.

Author: Floor Haalboom

Title: Fighting Salmonella: Struggles between Public Health and Agriculture in the Netherlands (1959-1978)

Abstract: During the 1960s and 1970s knowledge claims about Salmonella bacteria became food for vehement debate in Dutch society. Agricultural animals infected with Salmonella were turned into a major public health problem by scientific experts in a Health Council advice of 1962. The Council related a profound rise in the incidence of food poisoning among the human population to the presence of Salmonella bacteria among agricultural animals. Changes in agricultural practices were deemed absolutely necessary, especially decontamination of animal feedstuffs which were seen as the source of Salmonella-cycles permeating the entire Dutch environment. These scientific claims were not simply accepted in the agricultural domain. Rather, the 1962 Health Council advice formed the start of several decades of struggles between agricultural and public health networks on what the core of the salmonellosis problem was, how it should be dealt with and who was responsible for its control. Public health experts eventually felt they were the losing party. I will use the case of the salmonellosis problem to discuss dealings of different social networks with a problem which transcended cultural boundaries between animals and people, public health and agriculture, and science and agricultural practice.

Author: Jacob Darwin Hamblin

Title: Science and Supranationalism

Abstract: Jacob Darwin Hamblin is an associate professor of history at Oregon State University. His work focuses on the international dimensions of science, with particular interests in environmental and nuclear issues. His recent book *Arming Mother Nature: The Birth of Catastrophic Environmentalism* (2013) challenges us to examine how our views of global catastrophic environmental change are rooted in the collaboration between scientists and the military as they planned to fight and survive a third world war. Another book, *Poison in the Well: Radioactive Waste in the Oceans at the Dawn of the Nuclear Age* (2008), was the first international history of the longstanding practice and ultimate banning of dumping radioactive waste into the oceans. Hamblin is particularly suited to discuss conflicts of expertise not only across national lines, but also among the scientific communities that have cohered around intergovernmental agencies. In the course of his research, he has used the archives of several international organizations, including UNESCO, the Food and Agricultural Organization, World Health Organization, International Atomic Energy Agency, and NATO. He has published on the clashes between the IAEA and FAO, and between UNESCO and the UN Scientific Committee on the Effects of Atomic Radiation. Currently he is developing a book project that explores how a range of environmental problems—population pressures, energy shortfalls, potable water access, over-use of pesticides, and carbon emission—became vehicles upon which nuclear power advocates created the infrastructure of the world’s nuclear programs, often using UN- or alliance-based organizations to accomplish it.

Author: Christopher Hamlin

Title: What is Putrid about “Putrid” Fever?

Abstract: This paper explores the changing meanings of "putrid" fever from post-Galenic fever tracts of the early modern era through the nineteenth century. The clinical and pathological uses of the term "putrid" have received little concerted attention from historians. While the term is commonly encountered in medical texts, it was not a stable one: it is variously a theoretical term, a classification of a kind of disease, a clinical term for describing a suite of symptoms, an indication of seriousness, and perhaps a single distinct disease designation. I shall explore extensive as well as ostensive uses: Thus: does "putridity," used in the context of a disease or a set of symptoms, convey disgust, as it would later come to do? Equally, does the term link the internal to the external, acting as a pathological complement to concern about harmful decomposing matter in the external environment? While the paper reviews these concepts broadly, it focuses on the late 18th century when John Huxham, John Pringle, and James Lind explored clinical aspects, and more briefly on the emergence of putridity as a distinct feature of tropical diseases by the early twentieth century.

Author: Ben Harris

Title: From Chicago to Shutesbury Mass: Isabelle Kendig’s Conflict with Charles Davenport

Abstract: In the early 20th century, immigration and internal migration created urban disorder, which eugenicists analyzed and hoped to remedy. For evidence they turned to rural families and communities they viewed as dysgenic. To gather data, they employed a mostly female army of eugenic “field workers. One was Isabelle Kendig, raised in Chicago. Trained by Charles Davenport in the rural outpost of Cold Spring Harbor, Kendig was dispatched to the village of Shutesbury, Massachusetts to investigate the notoriously degenerate Pratt family. In 1914 Kendig spoke at a conference hosted by Davenport. Illustrating her work with a 75 foot long family tree, she revealed that the Pratts were not locally known as feeble-minded or poor. Rather, the whole town shared the Pratts’ sexual promiscuity and fondness for alcohol. Other field workers also seemed in revolt against Davenport, but most of the criticism “apparently rolled off his back like water,” Kendig wrote her father, but “my shafts evidently stuck.” Davenport’s revenge appeared in the *Journal of Heredity*, in a long quote from Isabelle that she never wrote or said, and that contradicted her observations about the Pratts. Based on family correspondence, archival records, and secondary sources, this paper presents a case study of the tensions inherent in eugenic studies of the early 20th century. They were created by male experts to address urban ills but were based on knowledge of rural life, collected by women. For at least some women, faith in eugenic theory was accompanied by a determination to follow scientific standards.

Author: Emily Harrison

Title: Data Under Development

Abstract: Infant mortality is a powerful transhistorical indicator, but what it indicates is ambiguous and highly sensitive to context. In the middle of the twentieth century, infants became subjects of a new frontier in medical science and the infant mortality rate was chosen to be the key metric for evaluating new experimental projects in economic and social development. As this happened, the stakes of ambiguity deepened. This paper is a study of ideas that emerged from attempts to apply new tools against infant mortality across local contexts -- specifically, sites in Quito, Delhi, and Boston where an American doctor named Leona Baumgartner participated in “cooperative” interventions on infant mortality sponsored by the US State Department between 1951 and 1965. Drawing on archival materials produced by Americans, Ecuadorians and Indians across socioeconomic and political spectrums, the study examines how the global interactions in these sites, mediated by modern tools and techniques, influenced not only the observed efficacy of the tools but also the emerging sciences of human development. The new scientific forms that arose had real-life consequences through the policies, practices, and ethics of intervention for medicine and public health. The cross-cutting historical narrative sheds new insights into the ways child lives have been valued at the global intersections of health and economic development

Author: Joy Harvey

Title: “Far from rejecting Tom”: Harvard and Thomas S. Kuhn, 1956 to 1976

Abstract: Thomas S. Kuhn left Harvard after a close connection with the university from his undergraduate days to a Junior Fellowship and Assistant Professor in the Committee of the History of Science, and Committee on General Education, he was not given tenure but went instead to the University of California, Berkeley in 1956. The possibility of his return to the faculty

of Harvard [first in 1963 and again in 1969 in the new Department of the History of Science, created in 1966 was blocked with a variety of excuses by members of the Committee and Department.. Though he never returned to the faculty of Harvard, he was involved in the support of other candidates, notably Barbara Gutmann Rosenkrantz.

Author: David K. Hecht

Title: The Power of Metaphor: Evolution and Economics in The Selfish Gene

Abstract: On December 13, 1976, Milton Friedman—the economist, free-market advocate, and newly minted Nobel Laureate—was in Stockholm to deliver a lecture and to accept his prize. That same day, *Publisher's Weekly* contained a brief notice about a forthcoming book that would soon become an influential bestseller: Richard Dawkins' *The Selfish Gene*. The precise confluence of these events was certainly arbitrary; Dawkins and Friedman had different agendas and different audiences. But from a broader lens, there was nothing accidental about the appearance of *The Selfish Gene* in a year during which Friedman's star shone brightly. Scholars usually consider Richard Dawkins as part of a narrative of the history of biology, and the publication of his famous book provides a convenient marker for when the re-emergence of genetics became broadly public rather than purely professional. But *The Selfish Gene* also needs to be understood as a product of the mid-Cold War. Like Charles Darwin before him, Dawkins relied heavily on economic metaphors to present evolutionary ideas to a broader public. The pages of *The Selfish Gene* are heavy with market ideology, and Dawkins frequently borrows from game theory—a quintessentially Cold War analytical tool—to make his point. These choices were not merely rhetorical. They shaped both the message of the book and its subsequent reception, frequently providing scientific sanction for ideas that were largely economic in origin, and knitting together evolutionary biology and market ideology in enduring ways. Friedman and Dawkins, it turns out, owe much to each other.

Author: Erik Heinrichs

Title: The Live Chicken Cure for Plague Buboes: Medical Experimentation in Late Medieval and Early Modern Europe

Abstract: This paper explores the character of medical experimentation through the long history of one seemingly bizarre remedy for plague buboes. Appearing often and in various versions between 1348 and the eighteenth century, the basic treatment involves placing a live chicken on a poisonous swelling, such as a plague bubo. This paper explores physicians' ideas on how the remedy worked, and more importantly, how the remedy changed over time from its roots in Avicenna's Canon through the arrival of the "Black Death" and up to its full blossoming in early modern times. This paper uncovers a long history of experimentation in the many extant versions of the remedy, drawing on the writings of physicians Jacme d'Agramont, Johannes Jacobi, Antonio Guarineri, Niccolo Bertucci, Caspar Kegler, Johann Reusch, and Ernst Reuchlin, among others. Focusing on the vernacular pamphlet literature of early modern German physicians, this paper also uncovers physicians' personal observations on the remedy's efficacy as well as the minor changes that they recommend. Through such cases, this paper describes medieval and early modern medical experimentation amidst changing relationships between theory and practice, ancient authority and personal experience.

Author: Brian Hepburn

Title: Ontologizing Activity: Operational Representation and Problem-Solving in Analytic Mechanics

Abstract: Wolfe (2012) has expanded our understanding of the use of Newtonian analogies in life sciences during the 18th century. The success of Newton's celestial mechanics legitimized the appeal to powers that could relate phenomena in descriptively accurate ways, but without requiring a commitment to the ontological status or grounding of the power. I describe a different ontological shift in analytic mechanics: not ontological agnosticism but rather the ontologizing of activity. The analytic form of mechanics allowed for the use of mathematical operations to represent dynamic interactions. In particular, dynamical interactions could be explained as equilibrium conditions among properties and activities. This representational affordance of analytic calculus can be seen as largely responsible for the explosion of problem solutions in 18th-century mechanics. At the same time, worries about the ontological status of powers were obviated by the commonplace of treating activities themselves as things.

Author: Evan Hepler-Smith

Title: Between Regulation and Information: Tracing Chemical Novelty

Abstract: The traffic and use of chemical compounds in medicine, industry, agriculture, and consumer products is subject to extensive global and national regulatory regimes: laws, rules, and institutions intended to safeguard human health, the environment, and economic interests against threats posed by the untrammelled production, circulation and use of chemicals. With more than 75 million small molecules known to the chemical sciences, regulators must rely on experts for more than just knowledge about the potential risks of individual substances. They must also draw upon chemists' databases and classifications to identify the contents of the chemical world. The chemical information systems that regulators rely upon were built for other purposes, however, and the articulation of these systems has material consequences. In this paper, I will address the Chemical Abstracts Service Registry and its use in the implementation of the Toxic Substances Control Act of 1976, a US law determining how the EPA was to regulate the testing and use of chemical substances. The CAS Registry was the product of a long history of the development of systematic nomenclature and notation conventions for identifying chemical substances. The choices that its architects made since the beginning of the twentieth century have affected whether the EPA counts new chemical products, including the new materials of nanotechnology, as "known" compounds covered by existing risk profiles or "novel" products requiring extensive testing. Such judgments can have significant stakes for health, the environment, and the viability of chemical enterprises.

Author: Daniel Hicks

Title: Practices as a Framework for History and Social Science

Abstract: This talk introduces my conception of social practices as a framework for descriptive and ethical analysis, a perspective developed from virtue ethics and modified through philosophy of science. A social practice is a complex, collaborative, goal-oriented activity. I discuss three of its core features (goals, normativity, and progress), drawing on my current work on commodified technoscience as an illustration. The goals of a practice are characterized by four features: they are intrinsically valuable, progressive, integrated, collective goods. Truth and understanding, classically understood, are such goods. The products of technoscience can, in some cases, meet these criteria. The goods of a practice are contrasted with "goods of efficiency," including wealth, power, and fame. For practitioners, such goods are valuable as resources; but there is a temptation to reverse this, treating the goods of the practice as mere means to goods of efficiency. This gives us a common understanding of worries about pure/applied science, commodification, and politicization. Practices have a normative structure; for example, norms for data analysis or research conduct. Practitioners generally understand these norms and goals in a realist, non-relativist way. Thus, progress is an important subsidiary goal. For example, pharmaceutical research seeks not only to develop new drugs, but also to improve the methods by which new drugs are developed. Progress can be stimulated by individuals who inhabit several practices and translate insights and ideas from one practice to another. In this way "values" — the goods of other practices — can play a positive role in technoscientific practices.

Author: Hiro Hirai

Title: Syphilis and Imagination in Paracelsus's Theory of Transplantation

Abstract: In his masterpiece, *The Idea of Philosophical Medicine* (1571), the Danish physician Petrus Severinus (1540/42–1602) formulated a distinctive theory of disease, the theory of transplantatio (transplantation). That theory sought to explain the emergence of hitherto unknown diseases by suggesting that pathogens underwent a sort of mutation in their species. Although modern scholars have noticed the theory's significance, its historical and intellectual roots have yet to be studied. Severinus elaborated his theory upon ideas advanced by Paracelsus (1493/94–1541) in his writings related to syphilis. Paracelsus was active during the decades after this novel and calamitous disease first broke out. Physicians carried on intense debates on its nature, origin, and cure, and Paracelsus emerged as one of the most important protagonists in those debates. Among his writings devoted to syphilis, our paper will focus on the treatise *On the Origin and Cause of the French Disease* (1529), in which his ideas on transplantation are most fully articulated. The primary basis for his notion of transplantation was his particular interpretation of how the faculty of imagination operated and how the heavens influenced earthly events. Paracelsus's discussion was also conditioned by his views on sexuality, together with his assessments of the sexual behavior of his contemporaries. Severinus's account of transplantatio should be understood in the context of its origins in Paracelsus.

Author: Nicholas Hirsch

Title: The Teleological Mind: Neural Networks and Identity in 20th Century Cybernetics

Abstract: While the mechanistic model of the human brain was not new to this period, early participants in the field of cybernetics were particularly interested in neural networks as an example of a teleological system guided by a system of homeostatic limits and feedback loops. One of the central points of cybernetics at its inception, at least as understood by early members of the Macy Conferences, was to focus on how the purpose of a complex system determines its behavior as well as its design. The way that the brain communicates within itself, processes information and then guides the rest of the body is a perfect example of this kind of system. Looking at the work of Arturo Rosenblueth, Warren McCulloch, Gregory Bateson, Heinz von Foerster, Humberto Maturana and Francesco Varela, this paper will briefly examine the development of mechanistic models of the human brain by cyberneticians in the mid-20th century, with a focus on attempts to reconcile the distinction between the brain and the mind. While this new understanding of the brain-body interface would result in the development of a new generation of “neuroprosthetics” over the last several decades, the problem remained in how this system translates into more abstract qualities like thought, emotion, and most importantly, identity.

Author: Andrew Hogan

Title: Discerning Patterns of Abnormality: Institutionalized Patients and the Postwar Delineation of Genetic Disease

Abstract: Throughout the 1960s and 1970s biomedical researchers worked to identify the discrete genetic causes of intellectual disability. An influential model for these studies was the 1959 demonstration, by Jerome Lejeune, that Down syndrome was caused by an extra copy of chromosome 21. Lejeune's finding was made possible in part by the well-established phenotype for Down syndrome, which was first described clinically a century earlier. The identification of additional genetically distinct forms of intellectual disability similarly depended on the clinical recognition of common phenotypes. Taking advantage of the concentration of intellectually disabled individuals among institutionalized populations, clinical geneticists sought, during the 1960s and 1970s, to identify subtle, but reoccurring patterns of abnormality. Common features were assumed to suggest a single genetic disorder and cause. This paper draws on archival sources, published medical literature, and interviews with clinical geneticists to examine the identification of two forms of intellectual disability, Fragile X and Angelman syndromes, within multiple institutionalized populations in the UK and Australia. I argue that large institutions for the intellectually disabled provided researchers with the opportunity to systematically delineate relatively rare, but phenotypically distinct, genetic disorders. Helped along by increasingly standardized approaches for seeing and communicating about bodily variations, clinical geneticists sought to identify reoccurring patterns of abnormality that were likely to be caused by a single genetic mutation. This paper traces the work of multiple physicians who worked in institutions for the intellectually disabled, a position that offered unique opportunities for identifying small populations impacted by the same genetic disorder.

Author: Eric Hounshell

Title: Questionnaire and Interview in the Social Research of Paul F. Lazarsfeld

Abstract: Twentieth-century social researchers inherited both the questionnaire and the research protocol from social surveyors and reformers of the previous century. A greater concern for verifying causal relationships between multiple subjective and objective variables, however, inspired the development of techniques for capturing respondents' subjective experiences and other “non-natural” data. Systematic experimentation, verification, and stabilization of questionnaire and interview techniques by practitioners across social science disciplines reached a highpoint in the 1950s. Codifying interview procedures—from the most formal “closed” questionnaire to the loose-jointed “open” depth interview—bolstered the reliability of social knowledge in the eyes of patrons while isolating and expurgating the factors of noise and bias that, for researchers, were obstacles to accurate measurement. This paper uses the work of sociologist Paul F. Lazarsfeld (1901-1976) and the center of research and training he founded at Columbia University, the Bureau of Applied Social Research (BASR), to elucidate the place of the questionnaire relative to other devices for controlling the collection and analysis of data. Though Lazarsfeld and his colleagues developed increasingly advanced techniques, the questionnaire did not experience a simple linear rise or decline in relation to other media and practices of social research: the rigid questionnaire could not guarantee objectivity by mechanizing the last traces of individual judgment, nor did it become obsolete with sophisticated flexible interview methods. The production of reliable social knowledge demanded the appropriate mixture of approaches for the occasion at hand. Even the most elaborate questionnaire did not obviate the need for protocols, guides, and apprenticeship training.

Author: Patti Hunter

Title: From Vienna to New York: Abraham Wald's Statistical Research and the American Mathematical Statistics Community

Abstract: An American mathematical statistics community, as distinct from the American mathematical research community that had fostered some of its members, was less than a decade old when Abraham Wald emigrated from Vienna in 1938. Trained as a mathematician, but having spent the 1930s working within a diverse network of economists, philosophers, and mathematicians, Wald joined a network in the United States that was equally eclectic. In the early decades of the twentieth century, a handful of mathematicians and social scientists had begun to feel that their common interests in the theoretical aspects of statistical research were not well supported by the existing research communities. By the time of Wald's arrival, they had begun to remedy the situation, creating a research journal and a professional society. Fleeing Nazi Germany, Wald moved to Columbia and became an active member of this emerging community, publishing theoretical statistics papers as well as contributing to war-related research with the Applied Mathematics Panel. This talk will analyze some of Wald's work and activities in the United States as well as his place in the American mathematical statistics community. It will argue that his contributions highlight the diverse nature of the community and suggest that by the mid-1940s, the community had carved out a niche for itself that occupied a space partly overlapping both the pure mathematical research community in the United States and a network of researchers in economics, physics, and other applied fields.

Author: Kaori Iida

Title: Genetics and the US-Japan Relationship in the 1950s

Abstract: Genetics in postwar Japan became one of the crucial sites for cultivating a better US-Japan relation in the Cold War. In this talk I aim to illustrate how the U.S. diplomatic interests and Japanese geneticists' interests interacted and shaped the understanding and development of genetics in Japan in the 1950s. I examine this issue through two controversial topics of genetics of the time: Lysenkoism and radiation. Japanese discussion of the controversial theory of Soviet agronomist Trofim D. Lysenko started in the postwar years under the American Occupation. Leftists introduced his theory immediately after the war as part of the postwar scientists' movement. Soon, Japanese geneticists participated in the discussion in a rather sympathetic way. One of the reasons for their sympathetic reaction was their long-standing interest in the role of environment and cytoplasm in heredity. As the Cold War divide deepened, however, they began expressing sharp anti-Lysenko criticisms that resembled many American criticisms because of a significant shift in domestic and international sociopolitical circumstances. In this talk, I would like to expand my analysis from this case of the Lysenko controversy to discussions of radiation in Japan. Through both topics of radiation and Lysenkoism, I hope to discuss what kinds of strategies the U.S. implemented to influence Japanese ideas and development of genetics in Japan in the 1950s, and how Japanese geneticists played a role in the story.

Author: Ashley Inglehart

Title: Robert Boyle on Ferments and Fermentation

Abstract: The concept of a ferment has described a vast array of processes. These include digestion; putrefaction; coagulation; internal heat of the blood and motion of the heart; the production of wine, bread, beer, cheese, and spirits; transmutation, the philosopher's stone and the alkahest; and the generation or growth of animals, minerals, and vegetables. The process of fermentation, moreover, has a central role in both vitalistic theories and those which adhere more closely to the mechanical philosophy of the seventeenth century. This paper looks at Robert Boyle's treatment of ferments and fermentation as discussed throughout his corpus. Boyle addresses the topic of fermentation in no less than forty treatises spanning over thirty years. Boyle's understanding of fermentation is, moreover, central to his more general world view. For example, in *Physiological Essays*, Boyle lists fermentation as being among the "more obvious and familiar Qualities or states of Bodies," that act as emergent properties from "the more Primitive" qualities of bulk, shape, and motion. By 1675, Boyle restricted his application of 'fermentation' to certain processes, and he remained surprisingly consistent about it for the remainder of his career. This notion of fermentation, perhaps derived from his experiments with Spirit of Wine, applied to his views on air, liquors, and even blood. By looking at Boyle's treatment of fermentation over time, I aim to show that throughout Boyle's career his treatment of fermentation was informed by both his mechanical philosophy and his experimental practice.

Author: Kenji Ito

Title: The Dispute over the Establishment of the Institute for Nuclear Study and Socio-Cultural Meanings of Nuclear Physics in Cold War Japan

Abstract: This paper examines the dispute over the construction of the University of Tokyo's Institute for Nuclear Study (INS) in 1954. INS was Japan's early nuclear physics research laboratory, which had relatively large accelerators, including a 1.3 GeV electron synchrotron and prepared the development of high energy physics in Japan after the 1970s. When it was announced that this institute would be built in a town called Tanashi, the locals opposed the plan. Intending to resolve the difference by "democratic" means, Japan's leading nuclear physicists, including Tomonaga Sin-itiro, went to Tanashi and held meetings to talk directly with the locals. By studying these dialogues and other statements, this paper will analyze the different understandings of the values and meanings of nuclear physics research among nuclear physicists and Tanashi residents in mid-1950 Japan. The paper further examines the resolution of the dispute. In the shadow of the atomic and hydrogen bombs, people in Tanashi considered nuclear physics as potentially dangerous because it could be converted into a military research project. For physicists, building a nuclear physics research institute was their attempt to find a path separate from, not just military but also civilian nuclear energy research, which was politically driven around the same time. While the people in Tanashi were not persuaded, the construction started, and the dispute was resolved by the fait accompli and the self-dissolution of the anti-INS movement.

Author: Taku Iwatsuki

Title: Intellectual Origins of the Quantification of American Sociology: The Case of Franklin H. Giddings

Abstract: This paper examines the intellectual factors that motivated Franklin H. Giddings' (1855-1931) introduction of a correlation-based method into American sociology based on analyses of his two early books, research conducted by him and his students, and archival materials. Statistical methods for causal inference based on information about correlations between variables (e.g., multiple regression analysis) are prevalent in American sociology today. Historical scholarship about the developments of these methods, however, is underdeveloped. Aiming to fill this gap, I describe the process by which Giddings introduced a correlation-based approach into American sociology.

Giddings' methodological ideas about the investigation of laws and causes through information about correlations had a huge impact on the quantification of American sociology (Bannister 1987, Chapters 4-5; Calhoun 2007, p. 29; Converse 1987, p. 47; Turner 1991; 1994). Major contemporary quantitative methods in American sociology are still under the strong influence of the methods developed by Giddings and his intellectual descendants (Turner 1991; 1994, pp. 42-51).

Focusing on Giddings' methodological motivation for the introduction of correlation-based causal analysis, I examine what methodological considerations were at work at the beginning of the quantification of American sociology. I show that Giddings developed his basic methodological position in his *The Principles of Sociology* (1896) through critical elaboration of John Stuart Mill's inductive methods. Then I argue that, in *Inductive Sociology* (1901), this methodological position played an important role in Giddings' adoption of the correlation-based method that he learned by reading the second edition of Karl Pearson's *The Grammar of Science* (1900).

Author: Catherine Jackson

Title: The "Methodical Production of Genius": Collective Practice and Chemical Theory in Emil Fischer's Laboratory

Abstract: Emil Fischer's laboratory is famous as an outstandingly successful site of group research. This was where Fischer and the chemists in his research group mastered Nature, stabilising a new and productive molecular world in three dimensions through their synthetic work on sugars and proteins. But, although it is a commonplace that science since the mid-19th century has been an increasingly large-scale, collective activity, few historical studies address the question of how group research operates in any detail. This paper uses a combination of archival and published material to reconstruct collective research in Emil Fischer's laboratory around 1900. How did Fischer's students and assistants contribute to the immense output of the laboratory? And what was Fischer's unique contribution as research leader? This paper begins to outline how such distinct roles were fashioned and fulfilled in Fischer's laboratory and how this laboratory economy provided a reliable mechanism for the progress of science. In so doing, it illuminates the changing economy of group research in late 19th and early 20th century science, enhancing our understanding of the varied status of individuals within the disciplinary community at the same time as it highlights the limits of training and labour.

Author: Frank James

Title: Chemistry and the British Board of Agriculture

Abstract: Board of Agriculture and Internal Improvement, to give its full name, was established in 1793 at the start of the war against France and was wound up in 1822. There is only a limited historical literature on the activities of the Board. Thus it is not clear what its overall significance was, if any, in affecting agricultural practice and production, especially as a number of extraordinarily wealthy landowners, such as the Duke of Bedford or the Earl of Egremont invested significant resources of their own in attempts to improve agriculture. Throughout its existence the British government contributed annually the substantial sum of £3000 to maintain it and for much of that time the Board had its offices in Sackville Street, a prestigious address just off Piccadilly in central London. In its early years the Board arranged extensive surveys of agriculture in Britain. The resulting volumes, each of several hundred pages, were mostly published on a county by county basis for England, but more by regions for Scotland and Wales. It also employed Humphry Davy (from the nearby Royal Institution) to deliver an annual course of lectures from 1803 to 1812 which resulted in his *Elements of Agricultural Chemistry* (1813). This talk will examine not only the roles that Davy played at the Board, but also his relations with the leading agricultural improvers of the day such as Bedford and Egremont, but also others such as Arthur Young and Thomas Bernard.

Author: Vladimir Janković

Title: Data Products and Outputs: Climate Services and the US National Climate Program

Abstract: Within a decade following the US Congress decision to enact the National Climate Program Act in 1978, the National Research Council released a series of plans for enhancing the management and dissemination infrastructures intended for handling of climate data products and services. The perceived need for improved climate monitoring, processing and use of data products, led to a series of meetings discussing end-users' needs and the economics of data acquisition, assimilation, and processing. Expert groups argued for a more stringent assessment of climatic impacts on society, especially in relation to the variations of climate that during the 1970s have affected provision of supplies, inventories and fixed investments such as dams or insurance policies. It was argued that the ad hoc (re-active) responses to climate variability cost more than those based on informed (pro-active) climate projections. In this presentation I revisit the cost-benefit arguments advanced by the government working groups to justify the design of service-oriented climate products and their role in improving economic resilience to climate variability.

Author: Michel Janssen and Jürgen Renn

Title: Einstein's 1913 Vienna Lecture: Modeling Gravitational Theory on Electrodynamics

Abstract: In his search for gravitational field equations from late 1912 to late 1915, Einstein vacillated between two different strategies. Following a "mathematical strategy," he extracted candidate field equations from the Riemann curvature tensor and checked whether these equations were compatible with energy-momentum conservation and would reproduce Newton's theory of gravity in the appropriate limit. Following a "physical strategy," he constructed field equations for the gravitational field in close analogy with those for the electromagnetic field. In his later years, Einstein routinely claimed that he brought his search for gravitational field equations to a successful conclusion in November 1915 by following the mathematical strategy. Most commentators have accepted this later assessment by Einstein but we have argued that Einstein achieved his breakthrough of November 1915 by following the physical strategy. In this talk, we analyze a 1913 text by Einstein that lays out more clearly than any other Einstein text of this period how his physical strategy worked. This text is the published version of a lecture Einstein gave at the annual meeting of the Society for German Scientists and Physicians in Vienna in September 1913. As long as one took Einstein's word for it that the breakthrough of November 1915 was the result of the mathematical strategy, one could quickly pass over the Vienna lecture in accounts of the genesis of general relativity. In our account, however, this lecture becomes a crucial source for understanding the method responsible for the crowning achievement of Einstein's career.

Author: Lijing Jiang

Title: The Troubled Escape from Chinese Lysenko: Questioning Pseudoscience in Postwar US-China Contacts of Biology

Abstract: The word pseudoscience, what Michael Gordin called "a term of abuse," had wide valence in twentieth-century

China. Having been previously used to mean “empty philosophy,” pseudoscience was attached to Mendelian-Morganist genetics during the Chinese Lysenko Affair. In the late twentieth century, however, the term switched to denote factually suspicious, often politically powerful practice. Instead of tracing pseudoscience strictly within national context, this paper compares two Chinese-American biologists, Ching Chun Li (1912-2003)’s and Man-Chiang Niu (1912-2007)’s experiences in forming US-China ties, doing biology in China, being criticized as practicing pseudoscience, and their subsequent defense. It shows the ruptured notion of pseudoscience in China is best understood as consequence of and circumstance for a continuing transnational dialogue about the relation between science and politics. In particular, population geneticist Li had worked under the Communist rule in the late 1940s when Lysenkoist doctrine was being promoted. He eventually fled to the US and devoted much energy in criticizing methodological unsound science in eugenics and intelligence testing while becoming a tenor in the chorus of denouncing Lysenko. Developmental biologist Niu, however, started to work with Chinese scientists in the 1970s. His projects on cytoplasmic inheritance that used mRNA to generate novel traits in goldfish and to transfer soybean protein to rice became heavily criticized in both countries in the 1980s. Niu was occasionally labeled as a “Chinese Lysenko.” I argue the disproportionately magnified criticism of Niu carried the momentum of US caution to sloppy methods and Chinese post-Mao skepticism of high political visibility.

Author: Katrina Jirik

Title: The Best Interest of the Child: Choosing Placement in an Institution for the Feeble-Minded in Early Twentieth Century America

Abstract: In the late nineteenth and early twentieth century, public institutions for the feeble-minded, a broad term that included people with cognitive impairments, immigrants and the poor, expanded across the United States. While male experts argued that expansion of institutions was necessary for the eugenic goal of preventing procreation, my review of correspondence, application forms and other documents presents a more complex picture. Application records reveal diverse motivations. Social workers occasionally cited eugenic reasons, but the details revealed parental death, poor care provided by the family, poor school performance, and even old-age dementia. Mothers and female relatives were most often the people making contact with the institutions. Some were seeking educational opportunity and vocational training while others sought lifetime care and supervision. Some would go to great lengths to obtain institutional services. For example, California law required that the parent and person to be admitted to the institution be state residents and correspondence indicates that some families actually moved to the state in order to obtain services. In New Jersey, mothers wrote to the governor demanding institutional placement for their child at Vineland. Women lobbied the state legislature in California for increasing the size of the institution because the 600 person waiting list prevented their child from receiving services at the institution. These women resisted the experts’ message of increased institutional placement for eugenic reasons primarily by ignoring them. They had their own reasons which were most often that institutional care was in the person’s or the family’s best interest.

Author: Matthew Jones

Title: Latent Analyses: Mining Networks, Traffic Analysis and Government Surveillance

Abstract: Central to recent concerns about US Government surveillance of communications is the bulk collection of ‘metadata’ from phones and internet connections. Legally considered not to violate privacy rights, this metadata proved of great interest to intelligence agencies and law enforcement alike. Even when communications are encrypted, metadata can be profoundly revealing of location, identity, associates, and power structures. Using graph mining techniques itself, this presentation will focus on the development of graph mining and social network analysis in the late 1990s and 2000s with substantial patronage from the intelligence community, most notably DARPA’s “Evidence Extraction and Link Analysis” program, a component of the infamous Total Information Awareness program.

Author: Edward Jones-Imhotep

Title: Drawing Trust: Circuit Diagrams and the Lost Practices of Cold-War Electronics

Abstract: This paper explores a hidden history of trust through the vanished drawing practices of cold-war electronics. For technologists in the early Cold War, the seemingly simple question of how circuits should be drawn entailed much deeper concerns: How should workers be commanded? What dangers arose as line drawings transformed into artifacts? How did people think and, not least, how could they be trusted? The various and competing methods for drawing electronic circuits in the 1950s and 1960s formed part of a set of cold-war anxieties over the possibility of rational individuals, and how to create them. Linked to programs in artificial intelligence and the post-war human sciences, with enormous stakes for the possibilities of self-governance, these debates fed into and off of a wider mid-century discussion about reason and democracy with consequences for Western political ideology during the Cold War. Within that context, technologists portrayed now-

defunct rules and symbols as structures to guide the fallible minds of humans. The paper concludes with thoughts about how the practices meant to underwrite the reliability of machines during the period were bound up with questions about the kinds of people we are understood to be.

Author: Abram Kaplan

Title: Natural Mathematics and the Account of Error

Abstract: In 1710 Bernoulli discovered what he believed to be an error in Book II of Newton's *Principia*. Reworking the mechanical problem of motion in a dense medium with the post-Leibnizian formalism prevalent in the Académie royal des sciences – an approach he considered more “natural” than Newton's geometric style – he derived a result that contradicted Newton's. While at first Bernoulli could not identify the source of the error, he soon attributed it to faulty manipulation of symbols: Newton did not distinguish the coefficients of the expanded derivative from those of the binomial expansion. (Lagrange would later attribute Bernoulli's attribution to a “remarkable” coincidence of Bernoulli's systematic symbolism for the binomial expansion with Newton's ad-hoc representation of the derivative.) While Newton, too, was quickly convinced that his original solution had erred, he vehemently objected to Bernoulli's explanation. Rather, he claimed, by comparing motion in both forward and backward time-directions, he had stumbled into an impossible solution easily remedied with a new diagram. Yet some months later he re-solved the problem using the original diagrammatic configuration. My paper looks at how Bernoulli and Newton's respective mathematical practice shaped their original grasp of Newton's error by foregrounding different features of his solution. It then contextualizes their explanations of the cause of the error within their broader epistemic commitments. While both mathematicians believed themselves to practice a more “natural” mathematics, they understood this in contrary ways, reflecting different understandings of the relationship between mathematics, mechanics, and natural philosophy.

Author: Judith Kaplan

Title: “Basic” Word Lists and the Universal Linguistic Subject

Abstract: This paper will examine the origins and development of “basic” word list questionnaires in historical linguistics during the second half of the twentieth century. Controversially first proposed in the mid-1950s by the American anthropologist Morris Swadesh (1909-1967), today these lists have become commonplace throughout the language sciences as tools for preliminary fieldwork and comparative investigation. The questionnaires isolate “basic vocabulary” in clear-cut opposition to “cultural vocabulary” according to the view that the former are essential to human communication—thus relatively frequent, entrenched, and resistant to change over time. Though the Swadesh lists have been challenged and refined on empirical grounds since the 1950s, more searching critiques have centered on the very possibility of semantic specification, language universals, and cross-linguistic comparability. Through an analysis of the ways in which researchers have justified and implemented these lists, I trace evolving ideas about homo loquens through a period of self-conscious globalization in linguistic research.

Author: Jameson Karns

Title: The Year of Balloons and Fireflies: Operation FuGo and the Militarization of Fire Suppression

Abstract: With limited offensive capabilities after the Battle of Midway, the Japanese developed an ambitious plan for attacking the United States from the Japanese mainland. Operation FuGo launched over 9,000 balloons armed with explosives into the jet stream, a natural phenomena then unknown to United States meteorologists. These balloons were designed to “bring fire to the enemy country” and cause crippling conflagrations within the forests and wildlands of the western United States. To combat the threat the American government launched Project Firefly, a top-secret operation that allotted the operational wing of the United States Forest Service to the military. My paper will explore how the Japanese used advanced meteorology to launch what Cold War defense analysts called “the first intercontinental ballistic attack”; why the attack failed; and how the government response to the threat altered the American landscape. Using recently declassified files, GIS mapping, and meteorological metadata, my work has reconstructed the environmental conditions that existed at every location in which the Japanese bombs hit American soil. While the FuGo bombs were completely ineffective (my climate reconstructions show how they landed during one of the least auspicious eras for forest fires in American climate history), the American response to the threat was transformative. Project Firefly systemically restructured firefighting techniques, equipment, and strategies, a system that is still in place today. This paper links meteorology, forestry, and fire science to explore the enduring impact of a distant war on the American landscape.

Author: Allison Kavey

Title: “If Therefore We Would Obtain Such Property or Virtue, Let Us Seek for Such Animals”: Animals and the Magical Theology of Agrippa von Nettesheim

Abstract: Animals play an interesting and complicated role in books one and two of Agrippa’s *De Occulta Philosophia Libri Tres* (1510/1533). In the book on natural magic, they illustrate the occult connections that can be learned and manipulated by a motivated student. Animals themselves have inherent virtues that can strengthen, quicken, embolden, or create love for a natural magician or weaken, slow, make craven, or cause enmity for an enemy. These virtues provide handholds by which the natural magician can manipulate the world to his benefit. In book two, animals become the subject of magical intervention. Magicians knowledgeable about the virtues of animals and minerals and their connections to specific stars and numbers can wield these connections to cause their horses to go quietly into battle while their enemies’ horses bolt in terror, gain the eyesight and power of the eagle, and cause illusions of hornets, bees, wasps, and rats to terrorize their foes. Agrippa’s use of animals in his magical theology is not novel among Renaissance hermeticists, but that makes it even more useful for understanding their ideas about the relationship between man and animals and the role of animals in the divine Creation. This paper will use books one and two of *De Occulta Philosophia Libri Tres* to sketch out a hypothesis for better understanding the human: animal connection in Renaissance occult philosophy and more thoroughly contextualizing the role of animals in the magical cosmologies of this period.

Author: Vera Keller

Title: Collecting Adepts: Joachim Morsius, the Alchemical Republic, and Early Modern Social Media

Abstract: Originally strongly associated with academic peregrinations, the album amicorum or book of friends diversified in various ways in the late sixteenth and early seventeenth centuries from Hungary to Scotland. For a lifelong traveler, editor, and agent such as Joachim Morsius (1593-1644) of Hamburg, the album was not merely a collection of memories from his student days. Rather, it was the essential networking tool through which Morsius investigated adepts and authors, traced relationships, and collected the copious liminary poetry beneath which his often slim editions groaned. While knowledge in transit has long been a particular focus within the history of science, early modern social media such as the album amicorum have yet to receive the attention they deserve as the premier networking tool seventeenth-century intelligencers deployed. This paper explores the ways Morsius utilized his enormous album (stretching to four volumes and over 1,000 pages) to uncover alchemical adepts, shape their personae, and market them within the world of alchemical print.

Author: Jordan Kellman

Title: Confident Men and Confidence Men: Taxonomy and Local Agents in Joseph Pitton de Tournefort’s Eastern Mediterranean Voyage, 1700-1702

Abstract: This paper explores the naturalist expedition of Joseph Pitton de Tournefort to the Eastern Mediterranean in 1700-1702, and the role of go-betweens in his construction of knowledge of its botany and mineralogy. Drawing on a new emphasis in the historiography of the birth of modern science that emphasizes the importance of knowledge brokers and agents in addition to knowledge creators, this paper uses Tournefort’s *Elemens de botanique* (1694) and his *Relation d’un voyage du Levant* (1717) as well as his manuscript correspondence to explore how Tournefort’s influential artificial taxonomical system prescribed methods of naturalist travel and collecting that were heavily dependent on local guides and fellow-travelers and their cooperation, connections and knowledge, not only for survival and access to plants, but in order to understand them in their local context. From the Armenian caravan that Tournefort travels with, to the band of Kurds who threaten their collections and their lives, Tournefort’s voyage, his collections and his understanding of them depends repeatedly on successful negotiation with local participants and those who intervene in the collecting process. While many naturalists, especially those who espoused natural classification systems, saw themselves as lone explorers in a natural landscape that could be fully appreciated and apprehended by the individual, carefully attuned naturalist, Tournefort’s artificial taxonomy led him to instead rely on an ever-expanding network of intermediaries to secure specimens and understand their environment, making his knowledge-gathering and the very knowledge that it produced thoroughly dependent on these go-betweens.

Author: Ashley Kerr

Title: Human Origins at the End of the World: Francisco Moreno, Florentino Ameghino, and the Invention of Prehistoric South America

Abstract: My paper on 19th century Argentina would nicely complement the ideas that have already been developed particularly of Moreno and Florentino Ameghino, both self-taught naturalists who proposed American (and particularly Argentine) origins for humankind. Despite their peripheral localization, both developed theories that eventually attracted the attention of European anthropologists and led to often brutal debates on the origins of mankind. While both their theories proved to be unfounded, the outcry these theories raised forced supporters of the European/Asian model to critically examine their own evidence and refine their arguments. Thus, the Argentine scientists played an important role in developing and furthering anthropological thought in the late-19th and early 20th century. Yet, their contributions have been ignored outside of those who study the history of science in Latin America.

Author: Andrew Kettler

Title: The Blinding Lights of the Blazing World; Margaret Cavendish's Utopias as Gendered Discourses on Proper Sensory Perception

Abstract: A deliberation over the proper use of vision for scientific experimentation frames a climax of Margaret Cavendish's *The Description of a New World, Called the Blazing World* (1666). Cavendish's protagonist, an empress in control of an otherworldly feminist utopia, was modeled autobiographically during the author's exile with the Stuart King Charles II. This fictional empress ruled over an environment consumed by excessive light, including a sense of the blinding capabilities of scientific rationality, and involving a respect for an understanding that human sensation was culturally constructed. When this empress ordered her male scientists to "break the telescopes" she was figuratively overturning a penetrating and surveying aspect of the Enlightenment which presupposed in women the incompatibility of scientific reason and inner passions. This *Blazing World* of Cavendish represents a historical moment in utopian literature born of Greek, Roman, and Christian utopian pasts which included an ongoing sub-textual debate over appropriate sensation for empirical reasoning. In this battle within discourse a figurative smashing of telescopes was a literal attack on the domineering sense of sight and its move to the zenith of the sensory hierarchy during the Early Modern Era. For Cavendish disrespecting the visual, through her accepting of the cultural construction of sensation and her application of metaphorical devices which showed the risks of unreasonable visual analyses, was a gendered performance. She took on the role assigned to her, as an ambrosial woman of inner, natural, passions, and mocked those who chose that role and that irrational sensory world for her.

Author: Paul Keyser

Title: Re-Appropriating Pliny in Late Antiquity and A Forgotten Pliny Epitome in the Vergilian commentator Servius

Abstract: Pliny's encyclopedia is one of the largest works to survive from Greco-Roman antiquity, and, because of its grand scale, was also one of the most often epitomized. Some epitomes are by named authors (e.g., the geographical epitome by Solinus). Others, mostly excerpting the medical books 20–32, are anonymous, with multiple versions: e.g., the "Medicina Plinii" of the early third century and "Physica Plinii" of the fifth. Despite all these epitomes, or maybe because of them, the work as a whole survived essentially intact. Overlooked, however, have been about twenty of Servius' many extracts from Pliny's *Natural History* that are not found in our texts of Pliny; some of the facts are not found elsewhere in ancient Latin literature. (The Vergilian commentator Servius composed his very learned work around 400 CE, and his notes are replete with extracts of otherwise lost texts.) The Plinian work cited by Servius focused on natural wonders, consonant with Pliny's work, especially books 2–11 and 33–37, and must have been an augmented version. Thus the story of the appropriation and adaptation of Pliny is enriched. Not only was his entire grand encyclopedia copied, and variously epitomized, it was also augmented. Did the unknown augments intend simply to expand Pliny, or was s/he producing a work like that of Solinus, a handy compendium based on Pliny, enriched with more recent scholarship? An augmentation might well have pleased Pliny, who was always eager, his nephew tells us in a letter, to learn some new fact.

Author: Kimberly Killion

Title: Bringing California to the Table: Myer E. Jaffa and the Pure Food Movement

Abstract: In the late 19th century, farmers in California began growing a diverse array of fruits, vegetables, and nuts in what

historian Donald Pisani calls the state's "horticultural revolution." As California farmers created cooperatives and used the transcontinental railroad to expand their markets, they sought to transform their products into staples of the American diet. At that time, the average American diet was generally composed of meat and starch, while horticultural products, such as raisins, were largely seen as luxury goods. Myer E. Jaffa, the University of California's first professor of nutrition and the first director of the State's Food and Drug Laboratory, played a fundamental role in promoting the nutritional value of California's agricultural products. Rooted in the California horticultural landscape, he worked not only to promote a balanced diet based in fruits, vegetables, and nuts, but also to protect California horticulture from the contemporary industrialization of food. My paper takes an environmental approach to the history of science, illuminating the influence of California's farmscape on Berkeley's first nutritional scientist. My paper also explores Jaffa's work outside of lab, as he advocated for consumers and farmers, in the faith that education, combined with government regulation, would eventually phase out processed foods. Jaffa's research influenced his promotion of "pure foods" and his leadership in passing California's Food and Drug Act. The paper concludes with the effect of World War I on his career, and the ultimate decline of his vision for pure food.

Author: Robert Kirk and Edmund Ramsden

Title: Dogs, Science, and the State: Inventing the Canine Hero in the Fight for the Health of the American Nation, 1948–1966

Abstract: On the 26th November 1948 John Tuck, a Pennsylvania dog breeder, was arrested whilst delivering dogs to Johns Hopkins University following accusations of cruelty. For Alan Chesney, Dean of the Medical School, this was the latest example of harassment that threatened not scientific research and education at Johns Hopkins but also the public health of the city, state and nation. This paper examines the scientific professions' response: combining political lobbying at the city and state level with an extensive public relations and education campaign, so as to win a city-wide Referendum in December 1950 securing a legal right for Baltimore institutions to seize impounded stray dogs for scientific research. In this campaign the scientific community successfully appropriated the unique human-dog relationship, hitherto used by antivivisectionists to portray experimentation as cruel, so as to portray dogs as willing participants knowingly contributing to the production of scientific knowledge. One dog, Anna, came to symbolize the concept of canine heroic sacrifice. Through newspapers, personal appearances, and a widely circulated short-film, Anna presented "her story" of the development of a surgical technique for saving the lives of so-called 'blue babies'. This approach became a model for national campaigns, conducted at state level, designed to create a favorable legal climate for animal experimentation. We conclude that the canine hero's active role in helping experimental scientists accrue favorable city and state-level legislation was a critical component in shifting the animal experimentation debate to the Federal level, contributing to the Animal Welfare Act of 1966.

Author: Dominic Klyve

Title: The Reception of Euler's *Letters to a German Princess*: Science and Religion at the End of the Enlightenment

Abstract: No work of Euler has been read by more people than his LETTRES A UNE PRINCESSE D'ALLEMAGNE, consisting of a series of 232 letters written to a teenage girl (the "princess" in the title) with the goal of teaching her science. Instantly popular when first published from 1766 to 1772, Euler's book was translated into eight languages and remained in continuous print for a century. However, very few readers, including those who read the book in its original language of French, read precisely what Euler wrote. Instead, editors of later editions and translators regularly made systemic changes in his text, often with no indication of such in their volumes. Some editors modified Euler's scientific theories, and others modified his frequent comments about religion. But all revealed more about themselves than they did about Euler.

Author: Maya Koretzky

Title: "A Change of Heart": Racial Politics, Scientific Metaphor, and Coverage of the First Interracial Heart Transplant in the African American Press

Abstract: This project investigates the history, media coverage, and ethical implications of the first interracial heart transplant, performed on January 2nd 1968 in South Africa, with a focus on the response to the operation in the African American press. Early coverage of the operation was overwhelmingly optimistic, portraying the transplant as a moment when technological innovation opened up new avenues for political opportunity and broke down barriers that other kinds of activism had failed to dismantle. The transformative power of the transplant lay in the new vocabulary it provided for critiquing racial discrimination. Reporters took advantage of the symbolic valence of the heart, and the metaphors it inspired, to translate the technical facts of the transplant to a widespread, popular, and racially conscious, American audience.

Although the medical success of the first heart transplants was dubious, and 1968 was widely remembered as a year of political disillusionment, it would be a mistake to dismiss the early transplants, and the political optimism they inspired, as failures. The reception of the operation in the black press reveals a new angle on both the American 1960s and the history of scientific innovation, showing that a medical breakthrough could catalyze social change, that narration and language matter in the translation of a scientific event to the popular imagination, and that it was possible to be optimistic about technological innovation and racial politics, even in a community with historical reason to distrust the medical establishment and during one of the bleakest years for the American left.

Author: John Krige

Title: Science and Supranationalism: Exploring the History of Science in Intergovernmental Organizations

Abstract: John Krige is the Kranzberg Professor in the School of History, Technology and Society at Georgia Tech. He has published extensively on the construction of major European scientific organizations for physics (CERN), space (ESA), and molecular biology (EMBO). Krige is the author of *American Hegemony and the Postwar Reconstruction of Science in Europe* (MIT Press, 2006), and has co-edited, with Naomi Oreskes, *Science Technology and the Global Cold War* (MIT Press, November 2014). His current project is *Sharing Knowledge Shaping Europe; Strategies of Nonproliferation*. At the roundtable, Krige intends to discuss how the European scientific community managed what Tony Judt has called 'The Problem of Evil' in postwar Europe, i.e. how they managed to reintegrate the German scientific community, many of whom colluded with the Nazi regime, into organizations like CERN and ESO (European Southern Observatory). He will emphasize that this was a genuine problem, that it was mostly suppressed at the personal level, but that it had marked effects on the institutionalization of physics and astronomy in these two organizations. Cold War imperatives, US assistance, the urge to facilitate European integration, scientific internationalism, and the determination to close the gap that had opened up between the US and Europe all played a role in 'overlooking' the problem of evil -- but it left a marked trace on CERN's early recruitment policy and stimulated the Ford Foundation to pay \$1m towards ESO's first telescope.

Author: John Krige

Title: Helping and Hindering Allies: the Transnational Circulation of Nuclear Information between the US and Europe from the Late 50s to the Early 70s

Abstract: From the late 50s to the early 1970s there was considerable exchange of classified knowledge on both nuclear weapons and gas centrifuge enrichment systems between the US, and the UK and France. What motives did the US have for sharing this knowledge, and what were the benefits and costs of collaborating with the US in these sensitive domains for the UK and France? Using recently declassified documents about US-UK and US-French relationships this paper will give a relatively fine-grained account of the kind of information that circulated across the Atlantic, it will draw attention to the mutual suspicion that is embedded in these exchanges, and it will emphasize the significance the US placed on maintaining leadership even as it shared important data with two major European allies.

Author: B. Harun Küçük

Title: Medical Experimentalism in the Ottoman Empire: An Introduction for Beginners

Abstract: In the late seventeenth-century, Paracelsian medicine made its initial appearance in the Ottoman Empire. Salih ibn Sallum, the first Ottoman physician to advocate European chemical recipes, and his school helped create a new drug market and expanded the textual horizons of medical scholarship. *Tıbb-ı cedid* or new medicine, as Ibn Sallum's enterprise was called, was a far cry from established Ottoman medical practices. While hygiene and diet were the main tools of old Galenic medicine, new medicine was innately pathological and its key instrument was drug therapy, embodied in countless seventeenth- and eighteenth-century Ottoman pharmacopeia. This transition from old medicine to new involved not only a redefinition of the disciplinary domain of medicine, but also a great deal of translation, comparison and experimentation. Practitioners of new medicine were often viewed with suspicion and, it was not until the 1720s that the new practices gained widespread acceptance and regulatory approval. In my talk, I will be focusing on Ali Münşi's (d.1747) *Bidaatü'l-Mübtedi* (*An Introduction for Beginners*), a mammoth compendium of chemical ingredients and drugs from the late 1720s. This text clearly shows the range of tools Ottoman physicians had developed in order to understand and assess European recipes, from a priori rejection of certain drugs to textual comparison and, from etymological excursus to methodological commentary.

Author: Whitney Laemmler

Title: Semaphores, Signals, and the History of Humankind: Alan Lomax's Choreometrics Project (1965-1985)

Abstract: In 1965, the folklorist and anthropologist Alan Lomax set out on a seemingly quixotic mission: to view, code, catalogue, and preserve the totality of the world's dance traditions. Lomax and his collaborators believed that dance was a unique, untapped resource for understanding the functioning of human culture and the history of human migration. Variations in dance style, they proposed, directly reflected crucial elements of a community's life history. As Lomax put it, it was "as if the body was a semaphore," signaling the presence of certain climactic conditions, work practices, and cultural values by "wig-wagging a special set of body parts." These signs, however, were not the gross stylistic differences immediately obvious to the untrained eye, but rather subtler elements—palm placement, force trajectories, degree of curvature—visible only through careful recording and analysis. To reveal these "underground rivers of style," Lomax employed Labanotation, a system of movement notation that broke dance down into its constituent parts. Once identified, Lomax believed that useful scientific data would immediately precipitate out of the maelstrom of everyday human movement, evidence just as powerful as "the point on a potsherd or the edge on a handaxe." This paper traces the history of Lomax's "Choreometrics" project, illuminating the ways in which human bodily movement came to be understood as carrying important and otherwise inaccessible information about social structures, work practices, and human history. Second, I explore why it was at this particular historical moment that the language of bodily cues, clues, and secret signals became so appealing.

Author: Matthew Lavine

Title: "What A Young Husband Should Know": The Rhetoric of Science and Adult Sex Education at the Turn of the Twentieth Century

Abstract: Adult sexual education in the United States in the late nineteenth century was often accomplished through "marriage manuals," of which hundreds of different titles were published by and for Americans from all walks of life. These books were manuals in a literal sense, aimed at providing direct and detailed instruction on proper sexual behavior. While some were written by physicians, the majority were written by people with no connection to the sciences whatsoever: members of the clergy, manners and etiquette experts, socialites, novelists, naturopaths and public intellectuals, among others. Nevertheless, most of these manuals are shot through with the rhetoric of science, explicitly invoking evolutionary biology, psychology, anthropology, zoology, anatomy and physiology. The yardstick for proper sexual behavior, in these works, was rarely what was "moral" or "decent," but rather what was "healthy," "natural," or "normal." Decades before the academic sciences had acquired the cultural significance that they would in the Progressive Era, and half a century before scientific study of human sexual behavior came into its own as a viable pursuit, marriage manual authors deployed clinical jargon and naturalistic explanations to bolster their own credibility—even authors who, in other writings, were overtly critical of science and the scientific establishment. By using scientific rhetoric to create an "objective" standard for behavior on a sensitive subject, even for audiences otherwise disinclined to take seriously the pronouncements of academic scientists, these authors were leading indicators of the potency such rhetoric would shortly have in the broader American discourse.

Author: Philipp Lehmann

Title: Winning a Battle, Losing the War? The Rise of Climatology and the Dilemma of Data Diversity, 1870-1910

Abstract: In the early 1850s, the German geographer Heinrich Barth came across rock carvings depicting large mammals and hunting scenes in one of the driest parts of the Sahara. About twenty years later, these images would come to serve as one of the most used pieces of evidence for postglacial climate change in North Africa. The carvings were, however, just one part of a diverse array of evidence for climatic changes, alongside geological information of land use, changing vintage dates, descriptions of the environment in classical texts, and oral accounts of rainfall patterns. The European debate over historical climate change helped climate scientists to forge an independent academic identity outside the more established fields. But the debate – and the process of disciplinary consolidation – also inspired an ongoing discussion over what kind of evidence should be considered valid in climatological studies. Around the turn of the twentieth century, some practitioners started calling for a more demarcated and, above all, comparable evidentiary basis. This paper traces the rise of climatology as an independent field of study through the history of the canonization of climate data. Discussions over what should be regarded as "good" data eventually resulted in a reduced diversity of climatological evidence. While this further delimited the field of climatology – this paper argues – it also delegitimized the work of some practitioners, led to ongoing and circuitous discussions over methodology, and ultimately decreased the cross-disciplinary appeal of climate studies in the first half of the twentieth century.

Author: Christoph Lehner

Title: Einstein's Realism between Mathematics and Physics

Abstract: Einstein's realism, long dismissed as a naive prejudice out of touch with the sophistication of contemporary physics and philosophy, has experienced a renaissance in the last decades. Many physicists, philosophers, and historians have argued that Einstein's critique of quantum mechanics has to be taken very seriously, but the exact meaning of Einstein's concept of reality, central to this critique, has been difficult to pin down. Instead of attempting to locate Einstein in the philosophical debates about realism, I propose to understand Einstein's thinking out of the historical context of his work. Through a historical analysis of Einstein's reflections on the meaning of his two theories of relativity, I will offer a new reading of Einstein's concept of "physical reality" as a methodological requirement and not an epistemological or metaphysical one, as it has been commonly seen. I understand Einstein's concept of reality as a philosophical analysis of the mathematical theory of invariants, and hence as part of his reflections on the relation between mathematics and modern physics. Rather than being disproven by the developments of twentieth century physics, I argue that Einstein's considerations throw light on the theoretical apparatus of modern physics up to this day.

Author: Stephanie Leitch

Title: Collecting Faces: Physiognomic Data in the Early Modern Print

Abstract: This paper treats several printed genres that coached observations of the world and endeavored to calibrate the eye of the observer. While generations of manuscript versions of the pseudo-Aristotelian *Secretum secretorum* listed features that could decode the moral traits of individuals, these lists were useless as field guides until synthesized and organized by illustrations in the mid-sixteenth century printed physiognomies. This paper will question the degree to which structured observations prompted by printed physiognomies helped develop visual acuity on the part of the observer. Although the "character heads" found in these books were themselves not derived from empirical experience, this paper will nonetheless argue for their stakes in raising physiognomy to an epistemic genre; productive here will be their kinship to other volumes that delivered ersatz observations, such as artists' model books and costume books that similarly dealt with facial and human variety.

Author: David Luesink

Title: The Social Network: Standardizing Scientific Terminology between Non-State and State Actors in Republican China

Abstract: This paper examines the standardization of medical and scientific terminology in early twentieth century China as a key activity of modern state-building. When China's imperial examination system was abolished in 1905, a variety of state and non-state organizations attempted to fill the void and replace Confucian orthodoxy, knowledge and institutions with those of science. But as the Beijing-based Republican government weakened after 1915, non-state actors became paramount, especially the Shanghai-based Jiangsu Provincial Education Association (JPEA). Despite its name, this organization came to function as a de facto Ministry of Education for much of China between 1915-1927, linking modern publishing houses to newspapers while establishing and dominating all manner of schools and universities in the culturally dominant lower Yangzi region and beyond. Key to establishing science as a replacement for Confucian orthodoxy was establishing a standardized technical terminology for publishing and teaching purposes. In 1915 the JPEA became the networking hub for a diverse group of medical professionals, scientists, politicians and linguists who sought to unify existing and translated terms into a single Chinese scientific nomenclature for each discipline. The apparently mundane work of the terminology committee was nonetheless always politically charged, and the Nationalist government eagerly absorbed the committee after establishing its Nanjing government in 1927. By exploring the network of the JPEA and the terminology committee together, this paper revises existing accounts of professionalization of physicians and scientists in China, and demonstrates how non-governmental associations anticipated, and were absorbed into, the state.

Author: Shenglan Li

Title: The Vital Link between Laboratory and Home: Scientific Nursing in Wartime China

Abstract: In 1937, Pao-shan Chin, the director of the National Health Administration, remarked that Chinese nurses were "the vital link between [the] scientific laboratory and the home in which its discoveries must be applied." Chin further

underscored that Chinese nurses should follow an American scientific nursing model to achieve national-health goals. Despite the disruptions and displacements brought by the war with Japan, the surviving American-style nursing training programs managed to negotiate between the freedom of transmitting its own ideals of nursing and meeting the Nationalist state's demands. One prime example of such a dilemma is the wartime Hunan Yale-in-China Nursing School, which struggled to remain as a private institution in order to ensure its American training standards. Meanwhile, its nursing students were required to cooperate with government officials for home visits, mass-education classes, vaccinations, as well as assistance in sporting contests, school hygiene, and rural health. In acknowledging nurses' particular significance in disseminating scientific and hygienic gospels, the government endeavored to nationalize the Yale-in-China nursing program and incorporate it into the state medical system throughout World War II era. By examining the ways in which nursing training and services were addressed to be scientific during the tumultuous period of wars (1937-1945), this paper argues that Chinese nursing profession that adapted the American model was critical to the Chinese Nationalist state's wartime efforts and visions of science, state medicine, and modernity.

Author: Adrianna Link

Title: Anthropology for a World in Crisis: Sol Tax and the Center for the Study of Man, 1965-1976

Abstract: Following the Second World War, many anthropologists feared that changing international politics and new technological advancements would fundamentally alter the traditional behaviors of the world's diverse populations. They sought to confront the rapid disappearance and physical extinction of cultures by creating an ethnographic record of the world's societies through a salvage initiative known as urgent anthropology. Advocates of urgent anthropological work believed that such a collection of cultural data would ultimately yield important insights into the question of what it meant to be human. This paper focuses on the urgent anthropological activities of the Smithsonian Institution's Center for the Study of Man. Founded in 1968 by Smithsonian Secretary S. Dillon Ripley and anthropologist Sol Tax, the Center was conceived as an interdisciplinary research program devoted to a comprehensive understanding of the interaction of human beings with their social, cultural, and physical environments. Under Tax's direction, the Center also became an international clearinghouse for urgent anthropological research, promoting the use of the human sciences for finding solutions to the crises of the modern age. By retracing Tax's involvement with the Center for the Study of Man, this paper argues that urgent anthropology came to encompass far more than a concern over disappearing cultures, in turn raising questions about the relationship of human beings with their environment, the function of the Smithsonian's museums for collaborative research, and the changing nature of postwar anthropology.

Author: Lawrence Lipking

Title: Unveiling Error: Robert Fludd, Thomas Browne, and the Harrow of Truth

Abstract: "The main intellectual problem of the seventeenth century," Basil Willey wrote long ago, "was the separation of the 'true' from the 'false,'" the great project in which Thomas Browne joined Francis Bacon "to clear away the vast deposit of pseudo-science and fantastic lore left over from the unscientific centuries." Stories about that project continue to dominate popular views of the Scientific Revolution. Yet Browne himself was not at all sure that he knew the meaning of truth. "Some truths seem almost falsehoods, and some falsehoods almost truths, wherein falsehood and truth seem almost æquilibriumly stated, and but a few grains of distinction to bear down the balance." Hence "Pseudodoxia Epidemica" (1646-72, Browne's great survey of "vulgar and common errors," struggles to find some way to separate the "true" from the "false." Meanwhile definitions of error kept changing. The rift between Browne and the hermeticist Robert Fludd, who never doubted that he knew the meaning of truth, exposes a crucial issue in the history of science: the constantly shifting, bitter, and unresolved arguments of early scientists about what counts as truth and what counts as error. This paper examines a moment when such arguments became clear and dramatic.

Author: Jean-Pierre Noël Llored

Title: Reconceptualizing Emergence from Chemistry: Connecting Continental and Analytic Philosophy

Abstract: "Emergence", as a philosophical concept, has been around for centuries, mostly for investigating the type of specificity that a "whole" can display in comparison with its "parts" taken in isolation, or related to one another. Notwithstanding their interest as soon as science is to be understood as the representation of the world, those approaches mainly provide formal definitions which do not enable philosophers to address the philosophical, moral, and political questions raised by the consequences of the actions of technosciences upon humans, ecosystems, and the Earth. This paper points out at how the interplay between an analytic study of the whole-parts-environment strategies developed by chemists and a historicized form of epistemology of the chemical practices involved within those strategies can be of crucial help in

order to reappraise the concept of emergence in the light of chemistry. To make our point, we will develop two examples taken from sustainable and quantum chemistry with the view to highlighting: (1) the mutual dependence of the levels of organization; (2) the co-definition of relations and relata; and (3) the constitutive role of the modes of intervention in the definition, always open and provisory, of chemical bodies and risks.

Author: Shi-Lin Loh

Title: Instruments of Modernity: Rentogen in Pre-war Japan

Abstract: X-rays are widely considered a landmark in the history of radiation technology and nuclear science. They revolutionised the relationship of human bodies to the practice of medicine, as well as the popular understanding of nuclear science. This paper proposes to examine the development of X-rays in Japan - or rentogen, as they were more often called in Japanese. It focuses on the end of the nineteenth and the first decades of the twentieth century. The analysis will follow two main avenues. First, it will present an overview of the Shimazu corporation, which built Japan's first medical X-ray apparatus; next, it will consider how these early X-ray machines changed the ways in which human bodies were understood in this period. Changing views of how physical bodies were linked to the national polity (kokutai) in part depended on these shifts in science and technology. The paper ultimately suggests that the creation and use of X-ray or rentogen technology was a crucial phase not only in the history of radiation, but also in creating the phenomenon of 'scientific modernity' within Japanese society.

Author: Jemma Lorenat

Title: The Figure and Other Forms of Geometric Evidence

Abstract: During the early nineteenth century debate over geometric methodology, Jean-Victor Poncelet distinguished pure geometry as reasoning in which "the figure is never lost from view." In all its guises, Poncelet presented the figure as the primary form of geometrical evidence, a means of justification based in sensory perception. Whether illustrated, described or constructed, the objects of geometry were emphatically representational and tangible. Thus, according to Poncelet, the convolutions of computations found in analytic geometry were hardly bearers of evidence. On the other hand, though classified as analytic geometry, Julius Plücker's contemporary research treated coordinate equations also as visual geometric objects by focusing on their form and endeavouring to avoid calculations. Working from Poncelet's division between pure and analytic geometries we thus ask how the figure based distinction materialized in contemporary geometric practices, and what constituted geometric evidence when the figure was lost from view.

Author: Lesley Lundeen

Title: Finding Your Way Outside Academe

Abstract: Interest in non-academic careers has exploded in the last few years, both due to the increasingly straitened academic job market and due to rising demand for expanded options. But many are unsure of how to start looking beyond tenure-track positions or how to advise their students in this type of career change. This paper will focus on best practices, common pitfalls and prevalent assumptions and misconceptions among those looking at careers outside academe at different stages of graduate school and after receiving the PhD. It will also highlight ways that universities can support their students and alumni in pursuing non-academic paths. The author will draw from data and trends among University of Chicago PhDs and PhDs nationally in the humanities and social sciences and argue that doctoral work can and does prepare PhDs for a wide variety of careers in a way that ultimately benefits all of academe.

Author: Eunjeong Ma

Title: Engineering: Applied Science or Not?

Abstract: This paper examines the development of cross-cultural exchanges between engineering and humanities at the university level in South Korea, ca. 1980-2011. It is based both on government's science and engineering educational policies over last decades and on interviews with students and faculty members in science and engineering departments. The paper traces a changing place of humanities in science and engineering education and its relation to the shaping of the identity of engineers. As a way to generate competitive IT engineers in the global market, in 2011 the South Korean government funded two major universities to create an interdisciplinary program at the undergraduate and graduate levels. Inspired by the success of Silicon Valley, the government viewed that the unique element of Silicon Valley's success lied in convergence or

collaboration between technology and humanities. This offered a challenging opportunity for engineers to define what core engineering courses are required to be a competent engineer. While retaining so-called ‘engineering identity,’ the engineering faculty has to reconfigure humanities-imbued engineering identity. In a way, there opened a contested epistemic and pragmatic space, where social scientists and engineers can work together. This latest approach to engineering education stands in stark contrast with that of 1980s when engineering was educated and promoted as ‘applied science’ to bring the national wealth into force. Thus, this paper traces the shifting dynamic between engineering, science, and humanities in the contexts of national development.

Author: Kate MacCord

Title: A Natural History of the Enamel Knot

Abstract: The enamel knot was discovered in 1913, and as of 2013, it is at the center of a growing paradigm in developmental evolution. At the time of discovery, the enamel knot was thought to hold explanatory power for tooth morphogenesis by mechanically shaping the outgrowing tooth. Currently, the enamel knot is thought to be a “morphogenetic control center” that shapes the tooth by physically and genetically moulding surrounding tissues. By the mid-20th century, however, the enamel knot was not only devoid of explanatory power, it was also relegated to typological obscurity. Over the 100 year history of this object, its connection to different epistemic systems has waxed and waned, leading to a Lazarus-like ‘biography’. This paper examines the ways in which the enamel knot has weathered different epistemic systems and explanatory frameworks, wherein its associated phenomena have been described and interpreted as everything from “an inert structure” and “a temporary reservoir of cells” to “a signalling center” and “a control center”. By following the history of this object as its role in morphogenesis and phenomena have oscillated within the scientific community, this analysis will show how science mediates our understanding of objects, and how objects themselves reciprocally affect science.

Author: Paige Madison

Title: The Meandering Paths of the Feldhofer and the Gibraltar Neanderthals

Abstract: In 1864, a fossil skull discovered in a cave called the Feldhofer Grotte in the Neander Valley near Dusseldorf, Germany, was named a new species, *Homo neanderthalensis*. In the years before it was named, this fossil received much attention in the scientific community and appeared in well-known nineteenth century texts such as Thomas Huxley’s *Man’s Place in Nature* (1863) and Charles Lyell’s *Antiquity of Man* (1864). Meanwhile, a skull from Gibraltar, later to be recognized as a member of *Homo neanderthalensis*, gathered dust in a cupboard. The Gibraltar specimen, discovered in 1848, was not discussed in any scientific texts after the Feldhofer fossil’s naming in 1864. This paper examines the paths of the Feldhofer and Gibraltar fossils along their meandering paths from their discovery in caves to their discussion and inclusion in scientific publications, in order to demonstrate the ways in which inclusion within or exclusion from epistemic networks shaped these similar objects. Additionally, this paper compares the two fossils’ scientific trajectories in order to ask why one skull received international scientific attention while another waited for over a decade to become a part of the scientific discourse. The paper will examine how, in the case of these two objects, factors such as geographical locations, institutions, and networks of communication shape the understanding of the objects and mold their trajectory.

Author: Linda Magana

Title: Confronting the Parasite of Puerto Rico: Power, Politics, and Hookworm Disease, 1898-1917

Abstract: The roots of the health disparities between the Puerto Rico and the mainland undoubtedly rest in the development of public health policy and infrastructure following the American occupation in 1898. Quite remarkably, Puerto Rican public health at the start of the twentieth century had the explicit attention of U.S. presidents, Congressional members, agricultural industry leaders, American labor unions, and the Rockefeller Foundation, an emerging titan of global philanthropy. Interests converged around the eradication of hookworm disease, a plague afflicting the vast majority of the laboring population and which severely inhibited productivity. An Army physician, educated in the rapidly innovating field of infectious disease at the end of the nineteenth century, identified the source of the disease in Puerto Rico and developed a systematic response program tailored to the needs of the local population. This paper examines the apparent paradox between the application of innovative public health practices and responses to epidemic disease and the failure to achieve long-term improvements in health outcomes. Responses to epidemics and the execution of disease campaigns became major sources of political conflict and subject to partisanship transcending the physical boundaries of the island and enmeshing one of the world’s first and largest biomedical philanthropies, the Rockefeller Foundation. The earliest decades of the U.S. involvement in Puerto Rico’s public health system has the potential to shed light on a situation that seems to embody the idea of a “failure to thrive.”

Author: Geertje Mak

Title: Different Forms: Touching Details of Measured Humans' Files around 1900 in The Netherlands

Abstract: This paper starts with three different forms used for noting down measurements taken from human bodies. One stems from a Dutch exploratory expedition in Dutch New Guinea in 1909, one from the instructions for Dutch prison guards for measuring their inmates (from 1896), and one from the archives of a Dutch state reformatory for girls, where the inmates underwent extensive medical examination and measurement during the initial observation period (between 1905 and 1952). These forms are connected to the historiographies of physical anthropology, criminology, reformatory pedagogy and the administration of individual identities. By comparing the different terrains on which physical anthropology was active, this paper aims to shift the attention from a critical discussion of its ideas, theories, categorizations and discourses to its practices "on the ground". The analysis will concentrate on the problem of fragmentation in relation to categorization and individuation. The abundance of detail present in the forms does not only offer a problem, though. The forms offer an almost indexical relation to a body in history – like a footprint. To touch upon that tactility of the forms, I will go into a detailed discussion of the three forms.

Author: Julia Mansfield

Title: A Global Laboratory: Studies of Pandemic Diseases in the 1800s

Abstract: In the Napoleonic Age, the study of pandemic diseases moved to the forefront of medical science. Two pandemics – bubonic plague and yellow fever – drew scientific attention in Europe. This paper argues that scientific interest in pandemics depended on political circumstances that made national boundaries more porous in the 1790s. The endeavors of Eusebio Valli (1777 – 1816) illustrate this historical development. Valli was an Italian physician educated at Padua who joined Napoleon's army in 1806 and toured with French troops to Ragusa, Spain, and France. Before and during his military service, Valli studied diseases that in his day represented the major, global threats to mankind. His medical interests sent him to Constantinople, New York, and Havana between 1803 and 1816. The trip to Havana ended his life with a case of yellow fever. Eusebio Valli's story illustrates features of French politics that promoted research on pandemics. His story overlaps with British, Spanish, and American experience because the essential historical factors were international. Imperial wars and open markets in North Africa, Europe, and the Americas heightened the risk of pandemics. Simultaneously, these factors enabled medical men to travel and exchange ideas through wider circuits that supported their research. This paper distills a peculiar conjunction of factors – virus diffusion, imperial expansion, and integrated markets – that promoted the study of pandemics by a multi-national body of doctors.

Author: Ry Marcattilio-McCracken

Title: Anthropometry by Any Other Name: Beautiful Children, Homely Parents, and a Blueprint for "Marriage from the Standpoint of Art"

Abstract: The book *Art and Human Genetics: How to Choose the Right Mate for You*, self-published by Kansas-born artist Corydon Granger Snyder, opens with a line that is immediately familiar to historians of eugenics. "It is hardly likely that any normal person would marry and have children," Snyder writes, "if he knew in advance that the children would be handicapped in life by extreme homeliness." The rest of the text makes it clear that by homeliness, Snyder means something else entirely. *Art and Human Genetics* is a polemic inhabited by concerns about race degeneration, beauty, normality, population control, and marital relations. It is also, unmistakably, about anthropometry and eugenics. Snyder was obsessed with measuring heads and this text clearly demonstrates that preoccupation. Through multiple editions from 1928-1952, his book offered a "rational [system of] birth control" with art and human genetics at its core. There is no mistaking that skull-measuring was a dominant ethos for Snyder and his work, but also that for him, measuring people went much further. It is unequivocally aimed at a popular audience, simultaneously an instrument of rhetoric and a master schematic. Somewhat anachronistic in its conception and execution, especially by 1952, it serves as a particularly incisive example of how, for some, phenotype continued to express in relatively uncomplicated terms ontologies of hereditary worth for both individuals and groups, which, for Snyder, had important implications for the future of the human race.

Author: Daniel Margocsy

Title: The Republican Army of Letters

Abstract: Historians have long argued that scholars in the early modern Republic of Letters participated in the free or gift

exchange of knowledge, which fostered the communal feeling of solidarity and egalitarianism amongst them. As this historiography argues, members in the Republic of Letters considered each other friends. Yet a careful reading of the early modern sources reveals a highly different world. First of all, the Republic of Letters was a relatively well-known term in the period, but it was not used all that frequently. Second, most early modern scholars pictured the Republic of Letters in military terms. It was not a peaceful and democratic state, but a site of war. Erasmus of Rotterdam, whom many credit with the popularization of this term, described the Republic of Letters in his *Antibarbarus* as a military army, and he called his fellow members to engage fight against the supporters of scholastic philosophy. In his renowned *Dictionnaire*, in turn, Pierre Bayle compared the Republic of Letters to the site of civil war, where the (lack of) rules of a Hobbesian state of nature applied, with fathers attacking sons and friends attacking friends in the name of reason. By carefully examining such canonical texts, I argue that the ideals of early modern scholarship were not based on solidarity and egalitarianism. In a period where most states were constantly at war with each other (and subject to civil wars, as well), the conceptualization of the world of letters as Republic meant its imminent militarization, as well.

Author: Jaime Marroquin

Title: Ethnography and Experience in Francisco Hernández's Mexican Natural History

Abstract: This presentation analyzes the evolution of the Western method of studying, conceptualizing and describing American knowledge. It focuses on the ethnographic and naturalist work of Francisco Hernández as it led to the advancement of therapeutics in early modern medicine. Early modern Iberian ethnographic method developed from new empirical and judicial practices, and from Renaissance humanists' rediscovered belief that grammar and rhetoric were the foundation of human knowledge. Through an examination of the evolution of Hernández's research method, I analyze the epistemological progression from natural philosophy to early modern natural science. I argue that the joint evolution of Renaissance natural history and Iberoamerican ethnographic history in Hernández's work was key for the incorporation of American naturalist knowledge into Western medicine and natural history. Hernández's work anticipates some of Bacon's scientific ideas in practice, specifically the conceptualization of the world through a natural history based on induction, systematic gathering of information and experimentation.

Author: Craig Martin

Title: Divination in Dreams and the Alleged Impiety of Aristotle

Abstract: Early modern scholars found numerous motivations for rejecting Aristotle as an authority. Many criticisms, such as for his reliance on syllogistic logic and his geocentric cosmology, are well known. Less renowned are his views surrounding the unconscious. In particular, polemicists pointed to Aristotle's theory of dreams as a result of his rejection of the possibility that God sends prophetic dreams. Francesco Patrizi listed Aristotle's denial of divine dreams as a reason to prefer Plato, the Dominican theologian Melchior Cano declared Aristotle's view as contrary to scripture, and the Jesuit Martin Del Rio's book on magic condemned Aristotle's position. The accused heretic Tommaso Campanella cited Aristotle's naturalistic understanding of dreams as a reason to forge a new natural philosophy. These scholars interpreted Aristotle's treatise on dreams as proof of his impiety and as a reason for rejecting Aristotelianism. Other scholars and Catholic authorities defended Aristotle's theory. While rejecting God as direct cause of dreams, Aristotle described dreams as being part of nature that is, as a whole, divine. Andrea Cesalpino interpreted this passage as suggesting Aristotle, contrary to widespread opinion, believed in demonic intervention. Jesuits at Coimbra adopted Aristotle's general explanation for dreams while adding evidence from scripture that miraculous dreams, beyond the scope of natural philosophy, exist. In this manner, Aristotle's theory of dreams became a touchstone in early modern debates over whether or not Aristotle's philosophy could be reconciled with Catholicism.

Author: John Mathew and Seymour Mauskopf

Title: The Translocate in the Making of Chemistry in British India

Abstract: This paper investigates the development of chemistry in British India during the 1830s and 1840s, and in particular the efforts of William Brooke O'Shaughnessy (1809–1889). Hitherto I have argued that the mediation of knowledge has largely fallen to the 'translocate', a term I have coined for a specialist expatriate whose long years in the area of colonisation renders him dually authorized to speak both to the 'native' voice as well as to the distant expert who has never laid eyes on the region in question. William O'Shaughnessy, in his capacity as professor of chemistry and medicine at the new instituted Calcutta Medical College, in 1841 published a *Manual of Chemistry* intended to put the most recent European practices and techniques within the financial reach of 'native' Indian students. This work was followed in short order by *The Bengal Dispensatory* (1842) and *The Bengal Pharmacopoeia* (1844), both of which drew on local nomenclature and practice, even as

considerable attention was paid to laying out the basis of chemical knowledge and practice at the time. The object of the Bengal Dispensary and the Bengal Pharmacopoeia was clear: first, the botanical identification of each plant; second, its chemical analysis; third, the preparation of its pharmaceutical products; fourth, its experimental use or trial in hospital practice. These efforts point to the significance of organic chemistry in this period, even as they draw attention to the place of claimed authority for the region on the part of O'Shaughnessy in his role as 'translocate'.

Author: Aaron Mauck

Title: Mapping Biocultural Pathways: Telomere Length and the Transformation of Social Epidemiology

Abstract: Over the last three decades, information gathering in public health has become increasingly informed by a "cell-to-society" interpretation of pathogenesis. Endeavoring to create a more comprehensive model of how society "gets under the skin" to contribute to poor health, this interpretation has encouraged the development of new professional networks comprised of laboratory researchers, epidemiologists, social scientists, and policymakers interested in developing novel biological illustrations of the physical effects of certain societal exposures. Central to this pursuit has been the identification and promotion of novel biomarkers, which often become the primary source of data public health researchers use to support their claims. In this paper, I explore the process through which one particular biomarker, telomere length, entered public health research and came to function as a measure of differential rates of human aging. Although the measurement of telomere length is now widely-employed within epidemiological research, the validity of this measure remains hotly contested, as do the research findings associated with this biomarker. In charting the success of the telomere research enterprise, I illustrate the broader role biomarkers have come to play within an emerging model of public health research and practice.

Author: Julie McDougall-Waters

Title: Tracing the Paper Trail of the *Philosophical Transactions*: Correspondence, Referees' Reports and Proofs, 1850–1885

Abstract: The process of getting published in the *Philosophical Transactions* of the Royal Society in the mid- to late-nineteenth century was a long and sometimes complicated one, which for some science authors induced anxiety about risking their claims to priority if someone else published on the same topic elsewhere before their work appeared in print, but publishing in *Phil Trans* was still often embarked on by practitioners of science as a necessary and effective way of communicating work to their colleagues. Science publishing at the Royal Society in the nineteenth century, however, was not just characterised by prestige versus the duration it took to get printed, and this paper pays attention to the paperwork involved in the editorial management of the *Phil Trans*, namely by the Society's secretary, George Gabriel Stokes (1819–1903). The passage from manuscript to print had several stages that required the physical circulation of paper including, inter alia, manuscript copies submitted to the secretary; abstracts of papers read at the Society's meetings; correspondence between authors and the Society; correspondence between the Society and its printers; proofs of papers; referees' reports on individual papers for the Council of the Society; reports to authors summarizing referees' comments; proof corrections from the author; and, finally, the printed paper. No one author had exactly the same experience, and I trace how the transmission of paper was an essential way for an author's work to be read, refereed and distributed by the Society, and how the volume of letters, reports and printed copies necessary for one article to be published in *Phil Trans* was directly connected to the individual and collective publishing practices of the Society.

Author: Francis Mckay

Title: Homo-Eudaimonicus: Wisdom and Happiness in Post-Fordist Capitalism

Abstract: Over the past 40 years, there has been an explosion of scientific interest in "happiness" through research on "subjective well-being" (SWB). At the same time, this research has been finding its way into public and private institutions across the world, influencing politics, healthcare, education and industry. What is unique about this discourse on happiness is that it hopes to reintroduce an "ancient" theory of happiness into political economy, what is called eudaimonia (the view that happiness is dependent upon virtue and wisdom). As such, it advocates a refiguring of the human, an overthrowing of the all too common figure of homo-economicus, in order to establish the long forgotten homo-eudaimonicus. This paper will look at the history of homo-eudaimonicus, by looking at the economic and neuroscientific technologies used to define this identity and bring it into governmental practice. In doing so, it focuses on a particular type of eudaimonic practice that has circulated the most widely in SWB research, namely, a Buddhist inspired practice called mindfulness meditation. What that history will reveal, I argue, is that the figure of the modern homo-eudaimonicus represents a new kind of paradoxical subject in post-Fordist society: a being for whom the pursuit of "virtue" and "wisdom" is above that of wealth, but who ironically has more

value in the global economy than the rationally self-interested homo-economicus, insofar as his psychological skill set enables him to align more easily with the forces of post-Fordist capitalism.

Author: Matthew McKenzie

Title: Regional Culture, Scientific Culture, and New England's Rejection of Russell's "Theory of Fishing," 1920-1934

Abstract: This paper will argue that for many in New England by the 1920s and 1930s, the fisheries took on racial, ethnic, political, and ideological significances that—more than national debates—influenced how New England fisheries scientists responded to E. S. Russell's "Theory of Fishing." For Harvard's Henry Bryant Bigelow, the region's fisheries crises offered an important opportunity to show how a heroic, hybrid lab- and field- based fisheries science could sustain New England's culturally resonant fishing industry, and in doing so, show how old-guard New England elites could adapt to the region's changing economics and politics. For US Bureau of Fisheries New England Director William C. Herrington, however, Depression era politics offered an opportunity to insert science into New Deal policies that would—like his colleagues in the UK—support fish and fishermen alike. Ultimately, Herrington's failure to establish the Theory of Fishing in New England resulted less from the internal and cultural dynamics within biology at the time, and more from Bigelow's success in tying fisheries science to the persistence of regional social and cultural traditions. In addition, Bigelow's success also called the tune for the region's fisheries management well into the 1960s, setting the stage for New England's fisheries collapse of the 1990s.

Author: Peter McLaughlin

Title: The Problems of Aristotle's Mechanics

Abstract: The short peripatetic treatise, *Mechanical Problems*, (24 columns in Bekker's Aristotle edition) presents us with the first documented theoretical reflection on mechanical knowledge in Europe. Although the text itself is a hodge-podge of disparate topics, parts of the work contain an ambitious program of theoretical investigation of technical devices, including the formulation of the law of the lever, a physical "law" expressed as a proportion. The point of departure for the tradition in mechanics that led to Archimedes, MP also had a crucial impact on the renaissance of mechanics in the early modern period. Between 1517 and 1629 four complete and two partial translations into Latin as well as some complete or partial vernacular translations were undertaken and more than a dozen extensive commentaries were produced. Although some humanist translators/commentators may not have entirely grasped the mechanical content, more often the commentators knew their mechanics much better than Aristotle did and often make it clear in their comments that they are aware of this. Thus the question arises, what these Renaissance experts thought they could learn from Aristotle: It certainly wasn't basic mechanical knowledge.

The interpretation of the text will answer this question, showing that they would have been able to learn something about theory formation and the transformation of practical knowledge into theoretical knowledge. The MP is an attempt to derive general theoretical concepts in an analysis of technical practice. One consequence of the analysis will be that the law of the lever was likely a later interpretative addition.

Author: Daniel Midena

Title: Questionnaires and the Epistemological Space of German Anthropology

Abstract: Over the course of the nineteenth century, scholars produced and distributed increasing numbers of scientific guides. These ranged from simple lists of questions composed by individuals to multi-disciplinary practicing instructions produced by scientific institutes for universal application—whether by a trader in the South Pacific or an expeditionary team in the Arctic. This paper examines anthropological Fragebögen [questionnaires] developed in Germany from the Berlin Anthropological Society's questionnaire for navy personnel (1871) to the Berlin Ethnological Museum's instructions for overseas Germans (1904). It uses the development of anthropological questionnaires in this period as a window onto the changing scientific practices of the nascent discipline of anthropology. This history tracks the changing practices and boundaries of 'fieldwork' in ways that highlight the extent to which the questionnaire reflected and defined the epistemological geography of anthropology. By outlining what information (if any) was collected, the paper will also explore the relationship between the stated purpose of questionnaires and how they were negotiated in the field in practice.

Author: Ion Mihailescu

Title: The “Physicization” of Mathematics and Early Twentieth Century Reforms in General Education

Abstract: While it is common to talk about the mathematization of physics, this paper presents an opposite movement in which mathematics was “physicized”: inherited views about its abstract and deductive nature were challenged by a presentation of mathematics as a practical, concrete, inductive and experimental science. These views had started being put forward by engineers in Britain and Germany in the second half of the 19th century. Arguments over the teaching of mathematics in technical and engineering schools soon moved to much larger debates concerning the purpose of general mathematical education and the reform of school curricula. Drawing inspiration from the teaching of physics, a group of engineers (centered around Finsbury College and the Central Technical Institute in London) proposed the reorganization of the classroom into “mathematical laboratories” (where the study of mathematics would start from concrete observations, measurements and experiments), the reordering of textbooks, the introduction of new topics, methods and tools (like calculus, functions and square paper) and a new correlation between different disciplines like geometry, algebra and physics. The paper argues that the involvement of engineers in the reform of mathematical education was an important strategy that allowed them to renegotiate their social and epistemological standing, but it was also consequential in redefining mathematics as a science and a discipline.

Author: Kendall Milar

Title: The Machine as Body: Nikola Tesla’s Telautomaton

Abstract: In 1898 Nikola Tesla displayed the first radio remote controlled device. The device, a “telautomaton”, was a three foot long boat and able to move under the controller’s direction without wires. Although originally intended to act as an instrument of war, Tesla began to think of his telautomaton as more than a mechanical device. The very language he used to describe it suggested that he believed he had created a new form of life. Instead of calling the components motors, propellers, rudders and detector circuits he referred to them as “organs for locomotion,” “directive organs,” and “sensitive organs.” In addition to his writings on his telautomaton, Tesla also grappled with his conviction of his own automatism. His writings suggest a familiarity with the work of René Descartes, Thomas Henry Huxley, Herbert Spencer and William Clifford. These scientists applied research in physiology, psychology, evolutionary biology and physics in their study to determine how automatic human actions were. Tesla incorporated these ideas into his own work but he attempted a different approach. Instead of attempting to reduce the human body to an automaton, Tesla attempted to construct as human of an automaton as possible. The telautomaton makes many of the nineteenth century theories on automatism concrete and offers a vehicle to examine these theories from the perspective of an inventor attempting to apply them.

Author: Emelin Miller

Title: Making Natural History Anatomical: Edward Tyson and Comparative Anatomy in Seventeenth-Century England

Abstract: Seventeenth-century English physician, Edward Tyson, believed animal dissection was the most effective way to understand the Chain of Being, so much so that he deliberately made natural history anatomical. He gained from this method an experimental, tactile solution to larger, conceptual questions about hierarchy in the animal world. His text, *Orang-outang sive Homo Sylvestris; or The Anatomy of a Pygmie* (1699), a dissection of a chimpanzee, exemplifies this effort in several ways. Not only did Tyson profess the authority of comparative anatomy in natural history, but he collaborated with William Cowper, another anatomist who used anatomical methods to study natural history. In his analysis of the chimpanzee, Tyson blended natural history and medical texts by incorporating elements of both types of texts; simultaneously, he refers at length to traditional authorities on these topics (Galen and Aristotle), as well as other anatomists and natural historians. He categorized anatomical characteristics of the chimpanzee and utilized that information to understand its relationship to man. Finally, Tyson diagrammed the chimpanzee with a common set of methods used to depict medical anatomy, represented by the works of Vesalius, Govard Bidloo, John Browne, and others. Tyson’s text is significant in that it reflects how seventeenth-century naturalists and anatomists understood likeness and dissimilarity between animals and humans and created a community utilizing this comparative approach.

Author: Michael Miller

Title: The Origins of Schwinger's Euclidean Green's Functions

Abstract: This paper places Julian Schwinger's development of the Euclidean Green's function formalism for quantum field theory in historical context. It traces the techniques employed in the formalism back to Schwinger's work on waveguides during World War II, and his subsequent formulation of the Minkowski space Green's function formalism for quantum field theory in 1951. Particular attention is dedicated to understanding Schwinger's physical motivation for pursuing the Euclidean extension of this formalism in 1958.

Author: Katya Mishuris

Title: Mental Testing in Russian Child Science, 1901-1936

Abstract: The paper will examine the advent of intelligence testing in late tsarist Russia as scientific technology, which was developed in tandem with the rise of Russian "child science" at the turn of the twentieth century. The paper will pay particular attention to the Russian discussions of the uses of intelligence testing in educational and psychological publications during the early decades of the twentieth century.

What methods were available to Russian child scientists? On what theoretical underpinnings were these methods based? Were these methodologies borrowed or invented? How and in what sense did the techniques of intelligence testing redefine the conceptions of "child giftedness"? Further, how did these conceptions come to be linked to the reformations of late tsarist Russia and the Bolshevik project of societal transformation? To answer these questions, the paper will explore the discussions and controversies around testing techniques in the Russian periodical literature and analyze the writings by Russian behavioral scientists and clinicians that were engaged in developing testing technologies (such as Alexander Nechaev, Grigory Rossolimo and Alexander Boltunov, among others). Conceptually, the paper will examine the rise of Russian mental testing technologies in the light of approaches developed in the history of science, social studies of science, and STS.

Author: Zoë Misiewicz

Title: From Petosiris to Ptolemy: Authorities for Celestial Knowledge in Late Antique Omen Interpretation

Abstract: In the sixth century CE, the imperial bureaucrat John Lydus assembled a collection of ancient knowledge about the skies in the form of an omen compendium. Lydus justifies his presentation of this material on several grounds: he asserts that he himself has observed its validity, and he draws on the authority of his venerable sources to support his claims. This paper will examine Lydus' interactions with his predecessors and their ideas in the work known as *De Ostentis*. It will consider his differing treatments of the Egyptian sage Petosiris, the Etruscan prophet Tages and the haruspex Tarchon, the philosopher Aristotle, and the "divine" astronomer Ptolemy. Along with numerous other authorities, these diverse figures were all seen as experts in understanding the universe, whose knowledge could be adopted for Lydus' own purposes. Within the text, these purposes range from the basic establishment of credentials through to the description of the cosmos in which celestial signs occur. The resulting work can well be described as eclectic. Lydus does not attempt to merge the voices of his predecessors into a uniform whole, but often presents them as individuals. Yet despite its variety, *De Ostentis* is thematically coherent. Lydus brings together predecessors from different fields of knowledge and different geographical regions specifically in the interest of omen interpretation. Divination, philosophy, and astronomy from around the Mediterranean are united here for a common cause.

Author: Gregg Mitman

Title: A Film Never Made: History, Science, and Memory in Liberia

Abstract: In 1926, Richard Pearson Strong, head of Harvard's Department of Tropical Medicine, led an eight-member scientific team to conduct a four-month long biological and medical survey of the interior region of Liberia. The expedition relied heavily on the economic, personnel and, physical infrastructures being erected by the Firestone Plantations Company to secure a viable rubber supply for the United States in Liberia. While Firestone's continued presence in Liberia is one lasting legacy of the expedition, so too is the motion picture record the expedition left behind. This talk embarks on a cinematic journey that follows the extracts of an expedition and the lives of a film never made, as the expedition footage takes on a new life in post-civil war Liberia.

Author: Hiromi Mizuno

Title: Visualizing the Network of Fertilizer under and after the Japanese Empire

Abstract: My paper examines the network of chemical fertilizer under the Japanese Empire and how this network was transfigured after 1945 in Cold-War Asia. By the network of fertilizer, I mean a network of science, technology, and resources that enable fertilizer factories to operate and stay profitable, including: chemical research laboratories; the multipurpose dams that makes large-scale agriculture possible and generates power for chemical factories; social scientists that collected agricultural and economic statistics; technocrats in economic planning agencies; corporations that built dams, factories, and fertilizers; and transportation systems that moved materials and products around. My goal for this presentation is three fold: 1) to collect fertilizer production and consumption figures and related industries' information from the Japanese Empire (Japan, Manchuria/Northeast China, Korea, Taiwan, and Southeast Asia) and the 1950s; 2) visually map the data and network; and 3) conduct exploratory data and social network analysis, using digital humanities tools (Gephi). Although such history is yet to be written, my hypothesis is that the colonial fertilizer network did not just go back to Japan after the collapse of the empire in 1945 but went to Southeast Asia via technical aid projects in the 1950s. Rather than telling the conventional story of what happens to chemical companies and fertilizer factories, however, my visualization of the network aims to demonstrate the highly complex and much wider picture of the infrastructure of the industry and its trajectory.

Author: Daniela Monaldi

Title: Quantum Mechanisms and the Microscopic-Macroscopic Divide

Abstract: Fritz London presented his seminal idea of “quantum mechanisms on a macroscopic scale” (today’s “macroscopic quantum phenomena”) at the Fundamental Particles and Low Temperature Physics conference, which was held in July 1946 at the Cavendish Laboratory in Cambridge, UK. This dual conference was the first international gathering of physicists after WWII, and represented a turning point in the historical development of physical research. London’s aim was to explain the low-temperature phenomena of superfluidity and superconductivity on the basis of the novel conception of matter that emerged from quantum mechanics. The premises and the impact of his theory are examined in the context of his controversy with Lev Landau and the broader changes in the international physics community.

Author: Manyong Moon

Title: Whose Trees? Disputes Over the Origin of the Yoshino Cherry and Cherry Blossom Festivals in Korea

Abstract: Among the hundreds of cultivars of flowering cherries, Yoshino-cherry (Someiyoshino in Japanese and Wangbot-namu in Korean) is the most popular and widely cultivated cherry tree in Japan and Korea. Korea's Yoshino-cherry was introduced and cherry blossom festivals began during the Japanese occupation (1910~1945). Since a wild Yoshino-cherry was discovered in Korea's Jeju Island, but no natural habitat was confirmed in Japan, Jeju became widely acknowledged as the site of origin of the cherry tree during the colonial period. However, Japanese researchers have adopted a different view since the 1950s and claim that Japan's Someiyoshino and Jeju's Wangbot-namu belong to different taxonomic groups. On the other hand, Korean botanists discovered other wild Yoshino-cherries and the Korean government designated the habitat as natural monuments in the 1960s. Using advanced methodology including DNA fingerprinting, many Japanese scholars have argued the hybrid theory of the Yoshino-cherry, which rejected the Jeju-origin belief. As of today, there seems to be no consensus among the taxonomists of Japan and Korea about the origin of the Yoshino-cherry or the taxonomic status of Jeju's native species. I'd like to discuss the different perspectives on the origin of the tree and also demonstrate how the belief of Jeju as the origin of the cherry has justified the Japanese custom of picnics under the cherry blossoms for Koreans. Tracing records of cherry blossom festivals and botanical research on cherry trees, I will analyze the interaction between scientific research and public awareness of cultural activities.

Author: Graham Mooney

Title: All Aboard the Poo-Poo Choo-Choo: The Exportation of Human Waste and Environmental Justice in Post-War America

Abstract: This paper is about the political and environmental aspects of human waste disposal in modern America. It reconstructs the ill-fated, two-month, 3,000-mile return journey in 1989 of a 63-car freight train containing 4,120 tons of

sludge, which traveled from a waste-water treatment plant in Baltimore to Louisiana's "Chemical Corridor" and back again. The paper explicates how this journey reflects the shifting terrain of municipal political economics in modern America. The train -- which a gleeful media dubbed the "Baltimore Poo-Poo Choo-Choo" -- became something of a human interest story as it sought to dump its smelly load in Arkansas, Mississippi and Louisiana. Although the export of human waste was fairly commonplace in this period, the paper argues that the layered geographies of social environmental justice in the American south caused the propulsion of the Baltimore Poo-Poo Choo-Choo to national fame. Activists and poor black southerners were briefly united with state and local government agencies in disgust at this out-of-place rotting matter, at a time when these groups were otherwise at odds over environmental injustices to do with chemical pollution.

Author: Kirsten Moore

Title: The Many Lives of Mosquito Nets: History of a Mundane Public Health Technology

Abstract: Mosquito nets, specifically insecticide-treated nets (ITNs), became a major pillar of global malaria control in the late 1990s, a seemingly cost-effective solution for Africa's intractable malaria problem. Tropical disease specialists 'rediscovered' these mundane technologies, chosen because they were relatively cheap and simple to use, in the 1980s after more complex malaria treatment and control technologies had failed. Subjecting nets to a series of randomized control trials under a variety of experimental conditions, these researchers constituted mosquito nets as biomedical objects and legitimized their mass roll out in malaria-ridden areas. However, as researchers recognized, people had been using mosquito nets for over a hundred years, not only as a barrier for mosquitoes but also as mosquito traps in scientific investigations of malaria transmission. Since the roll out of mosquito nets started in the 1990s, people have used the nets for a variety of unintended purposes, including fishing, protecting vegetable gardens, and repairing hernias. This paper examines the reappropriation of mosquito nets by scientists, medical practitioners, and ITN recipients to show how these objects have shaped or given rise to lines of scientific inquiry. At the same time, the changing scientific bases of public health have shaped the way people consider these nets scientific objects. Using perspectives from the history of science, medicine, and technology, this analysis of a mundane technology will show how the multiple uses of an object allows for possibility in the production of scientific knowledge and how the production of this knowledge in turn shapes an object's use.

Author: Robert Morrison

Title: Scholarly and Scientific Exchange in the Eastern Mediterranean in the Fifteenth and Sixteenth Centuries

Abstract: My recent article in *Isis* described the role of Moses Galeano/Musa Jalinus as a scholarly intermediary between the Ottoman Empire and Renaissance Italy. The article focused on his role as a probable transmitter of planetary models that appeared in Copernicus' *De Revolutionibus* and different models that appeared in the homocentric astronomy of scholars associated with the University of Padua. The article found that Galeano/Jalinus was part of a network of Jewish scholars who had contact with Christians in Italy; the network bridged Istanbul, Crete, and the Veneto as well as Jewish, Christian, and Muslim intellectual life. The current presentation will focus on the broader context of the scholarly exchange that this scholarly network facilitated. The presentation will make three main points. First, the network facilitated a conversation that was about far more than theoretical astronomy. Astrology, medicine, philosophy, astronomical tables, and Qabbalistic thought were all topics of exchange. Second, the Jewish scholars, as well as figures at the Ottoman court, could be quite interested in European ideas. Focusing solely on theoretical astronomy obscures the fact that the larger conversation was bi-directional. When we consider the broader outlines of the conversation, it becomes even clearer why the Jewish scholarly intermediaries would have sought out Christian scholars. Third, this scholarly network seems to have grown out of mercantile connections. It is fitting, then, that knowledge, instruments, and texts remained commodities throughout the history of the scholarly network.

Author: Gregory Moynahan

Title: Adolf Meyer-Abich and the Foundation of Theoretical Biology

Abstract: This talk will address the complex institutional and scientific career of Adolf Meyer-Abich (1891-1971), perhaps the most influential mid-century proponent of "theoretical biology." Meyer-Abich developed the 'logic of biology' on which later systems theory would partially develop, and was instrumental in developing biological research institutes and libraries across Latin America, beginning in Chile, from the late 1920s to 1960s, as well as for providing the institutional and academic backing for the field in post-war Germany. In his fraught relation with the Nazi party, his long period of isolation in the New World, and his recasting of the field following the war, Meyer-Abich epitomizes the complexity and fungibility of the political meaning of theoretical biology. Particularly through the work of Heinrich von Foerster and Ludwig von

Bertalanffy, Meyer-Abich's early logic of biology was developed into a new means of understanding complex systems of wide import in the natural and social sciences.

Author: Samantha Muka

Title: From Browne to Andon: Building the Biography of the Jellyfish Aquarium

Abstract: E.T. Browne designed the first artificial system for maintaining jellyfish for experimentation at the Plymouth Marine Laboratory in 1898. Utilizing found materials, Browne simulated natural tidal motion in the laboratory. The system extended the life of jellyfish in the laboratory, but it was far from perfect- it extended the life of several species, but few subsequently thrived and reproduced in captivity. Subsequent changes to the system were made in university laboratories, public science institutions, and by home aquarists, eventually allowing researchers to maintain and actually rear several species in captivity by the early 2000s. In 2010, Alex Andon took this technology a step forward by shrinking complicated laboratory and home systems down into a desktop aquarium capable of maintaining jellyfish in the average domestic home. With the help of a Kickstarter campaign, Andon successfully mass-produced the first table-top aquarium designed specifically for cnidarian. Today, home aquarists can purchase Jellyfish Art's system, including three moon jellies (*Aurelia aurita*), artificial sea water, and food. The technology was named the best new product at the 2011 Global Pet Expo. This paper seeks to build the biography of the jellyfish aquarium from Browne to Andon. Specifically, I will focus on the challenges of tracing a linear biography through a wide-spread community of users and uses.

Author: Projit Mukharji

Title: Fermenting Vernaculars: Pasteur, Putrefaction and Colonial Agro-Industries, Bengal, 1900-1914

Abstract: Louis Pasteur radically transformed the way scientists approached putrefaction. A seemingly natural process of decay through Pasteur became a complex, classifiable and controllable process. This transformation was to have significant impact upon the numerous agro-based industries where fermentation was of crucial importance. Along with other developments in chemistry, it was Pasteurian Agro-bacteriology that came to inform and engender the so-called Second Industrial Revolution. In colonial contexts this had a powerful, but woefully understudied, impact. Traditional agro-industries were reformed and made more productive through the deployment of new chemical, botanical and managerial methods. As a result, the older relationship between capitalism, colonialism and science itself was remade. Yet, unfortunately, Pasteur's influence in India has been studied almost exclusively from the point of view of medical bacteriology. In this paper, using the voluminous and influential writings of the Bengali chemist, Nitya Gopal Mukerji, I will explore the ways in which Pasteurian ideas about putrefaction were tailored to suit the vernacular realities of Bengal's colonial agro-industries. Through this investigation I also hope to illuminate the changing relationship between colonialism, capitalism and science at the beginning of the twentieth century.

Author: Dmitriy Myelnikov

Title: "A Boutique Operation": Making Transgenic Mice in the 1980s

Abstract: Laboratory mice modified to carry foreign genes were reported in 1980–81 by six independent groups in the USA and Europe. Pursuing direct injection of DNA into one-cell embryos, these groups relied on alliances between developmental and molecular biologists, made possible by the growing circulation of isolated genes. Through direct contact, courses, conferences and handbooks, these new 'transgenic mice' were adopted globally, with several hundred labs engaged in their production by 1990. However, despite considerable interest from the burgeoning biotech firms and big industrial players, as manifested in the controversial 1988 OncoMouse patent, transgenic production remained heavily concentrated in academic laboratories that could afford the required combination of skills, instrumentation and animal infrastructure. Scientists involved in modifying mice have referred to the field as a "boutique operation" and a "cottage industry". In this paper, I argue that disciplinary divisions, publication practices and considerable barriers brought transgenic mice into a bespoke tool niche. This mid-scale, artisanal production relied on pre-existing lab animal infrastructure, but it also jarred with the established practices of mouse supply – it wasn't until 1995 that Jackson Lab, the key global mouse provider, started advertising transgenic strains. Based on several co-existing models of production and collaboration, the middle-scale transgenic operation enabled the actors to make novel molecular knowledge by aligning it with common alternative experimental systems, while promoting the future promises of transgenic technology.

Author: Barbara Naddeo

Title: Archives, Science, and the State

Abstract: In her contribution, Barbara Naddeo will discuss the archives of eighteenth-century statisticians, who famously collected, compiled and even interpreted demographic, financial, institutional and topographical information about polities and their lands for the state. In particular, she will revisit the question of the political power immanent to such archives, by pointedly examining the oftentimes unintended consequences of the processes of data gathering and brokering that constituted archival documentation as well questions of access and propriety rights to these same archives, processes and questions whose complexity, as she will show, made the archival project both a bastion of power and multi-faceted site for its negotiation.

Author: Maika Nakao

Title: Radiation and Spiritualism in the Empire of Japan

Abstract: This paper aims to explore linkages between radiation science and the discourse of spiritualism in the Japanese Empire. In the early twentieth century, the knowledge of radiation came to be known to the Japanese public as it has special efficacy to heal the human body. The concept of radiation harmonized with Japanese traditional values and even created new traditions. One can see this fusion of radiation and traditional culture in people's lives and commercial culture through radium hot springs and radioactive commodities such as pills, cosmetics and groceries. There arose the question of how the Japanese perceived the existence of invisible radiation. Interestingly, there were many people who have described radiation in spiritual terms. The spiritualism boom in the late Meiji and Taisho eras (1900s to 1920s) is well documented, as is the fact that it came from Western influences. At the same time, the scientific knowledge on radiation also came from the West. How were these two factors linked and what were the similarities and differences between the Japanese and Western countries? In investigating these questions, this paper tries to rewrite the map of the transits of scientific ideas about radiation and religious-philosophical themes of spiritualism in the age of Imperialism.

Author: Carla Nappi

Title: Translated Kinds

Abstract: What are the implications of Hacking's philosophy of language for translating "kinds" across language groups or modes of communication?

Author: Amy Nelson

Title: More than a Fox, Not Quite a Hound: Re-thinking the Culture and Science of Domestication

Abstract: In the 1950s, when official Soviet doctrine rejected genetics in favor of a neo-Lamarckian theory about the heritability of acquired characteristics, Dmitry Belyaev (1917-1985) launched one of the most significant longitudinal studies of the genetics of behavior and the domestication process. By selectively breeding silver foxes for tractability and interest in humans, Belyaev produced a colony of domesticated foxes whose morphology, behavior and genetic make-up have provided valuable insight to scholars across the disciplines of the natural and social sciences. This paper examines the significance of the Belyaev fox project to contemporary research on domestication and considers the ethical and conceptual issues raised by the foxes themselves. It shows how Belyaev's work informs theories of domestication that complicate and even contradict his original premises about how domestication works and what it is. It considers how researchers in the life sciences have come to understand domestication as a multi-lateral evolutionary process rather than a human-directed project and examines Belyaev's influence on social scientists and humanists who see domestication as a relationship conditioned by inter-species interaction as well as biology. Finally, the paper explores the contemporary legacy of the Belyaev foxes as animals occupying multiple conceptual categories, including research subject ("dog-in-the-making"), commodity, exotic pet, and status symbol. Examining the impact of the Belyaev fox project beyond the laboratory opens up intriguing spaces for conceptualizing agency beyond the human and a social fabric thickened by inter-species relationships.

Author: Nicole Nelson

Title: Techniques of Care, Techniques of Science: Interactions between Scientists and Welfare Technicians in Animal Behavior Genetics

Abstract: The practice of caring for laboratory animals in the United States has undergone substantial transformations in the past fifty years: what was once a task carried out under the supervision of individual scientific researchers is now subject to numerous regulatory guidelines and is increasingly carried out by independent staffs of animal welfare technicians. This paper examines the interactions between welfare technicians and scientists around animal housing and animal handling in behavior genetics laboratories, drawing on ethnographic participant observation and interviews. Examining the day-to-day interactions of scientific researchers and welfare technicians and how they borrow from each others' material and conceptual practices suggests new answers to the question of how welfare concerns have impacted scientific practice, answers that move beyond conceptualizing welfare technicians as either merely restricting or supporting scientific research without affecting its epistemic content. The increasing prevalence of welfare technicians and welfare concerns in the laboratory, I argue, both bolsters and troubles how behavior geneticists have historically understood and managed interactions between laboratory animals and their environments. On the one hand, the popularization of techniques and concepts originating in behavior genetics by animal welfare staff has lent credence to behavior geneticists' claims about the scientific importance of environmental factors in animal research more broadly; but on the other hand, the disassociation of these practices and concepts from their academic origins and their realignment with the concerns of the animal welfare staff generates rhetorical and affective connections that pose threats to the credibility of behavior geneticists' scientific work.

Author: Elizabeth Neswald

Title: When Experimental Subjects Kick Back: Resistance, Cooperation and Collaboration in Nutrition Experimentation

Abstract: This paper investigates experimenter-experimental subject interaction in nutritional physiological experiments in the second half of the nineteenth century. Nutritional physiology emerged as a specialist field in this period and looked to physics and chemistry for experimental models. Unlike the objects of the exact sciences, however, these physiological subjects proved to be both tenacious actors with their own interests and agendas and necessary collaborators and partners in the experimental process. Due to the structure and assumptions of these experiments, participation could not be coerced. On the contrary, cooperation was a fundamental part of how these experiments were conceived and necessary for their successful completion. They required subjects that voluntarily ate experimental diets, breathed normally in metabolism measurements, collected their excreta, recorded physical and environmental measurements, and engaged in diverse physical activities. The subjects' active cooperation and even trained assistance were essential. In this paper, I uncover traces of the history of experimental subjects in nutritional physiological research and explore the ways in which experimental cooperation emerged, succeeded or collapsed. While most historical research on human experiments in the physiological and medical sciences focuses on abuses of power, coercion, and questions of informed consent, presenting the researcher-subject relationship as one based on manipulation and exploitation, experiments in nutritional physiology seem to contradict this general assumption or, at least, to demonstrate that experimental relationships were more complex.

Author: William Newman

Title: Laboratory Replication of Newton's Chymistry

Abstract: The replication of historically significant experiments has recently begun to receive increased attention among historians of science. In part this follows naturally from the current focus on material and visual culture in the discipline, since replication necessarily involves hands-on work with materials and apparatus and the results often lend themselves to video or image-capture. But there is more to the story than this. Historians of chymistry have come to realize that re-creating the recipes and protocols of early modern practitioners yields valuable insights into the complex interaction of theory and practice that characterized the early modern field of alchemy-chemistry. A particularly cogent case for the necessity of laboratory replication can be found in the chymistry of Isaac Newton, as I will argue in my paper. The million-plus words that Newton devoted to chymistry consist of multiple literary genres - reading notes, concordances, florilegia, theoretical treatises, and experimental notebooks. The task of deciphering this material is an immense project rendered even more difficult by the fact that Newton held idiosyncratic interpretations of his alchemical forebears and even created his own graphic symbols for the materials that he used in his laboratory. In my paper, I will argue that Newton's goals and procedures can best be deciphered by employing hands-on replications of the processes described in his laboratory notebooks. I will also show how techniques of computational analysis (Latent Semantic Analysis) can help to facilitate this goal when employed in conjunction with laboratory replication.

Author: Kärin Nickelsen

Title: “Light and Life: The Emergence of the Photosynthetic Unit from the Delbrück Seminars”

Abstract: The discussion circle that formed around Max Delbrück was by no means exclusively interested in genes. The mechanism of photosynthesis was a second theme that held the group together, although this has rarely been recognised so far. This paper explores how the (then revolutionary) concept of a “photosynthetic unit,” famously proposed by the (bio)chemist Hans Gaffron and the physicist Kurt Wohl in 1936, emerged from these discussions and how this idea would influence the further development of photosynthesis research and neighboring fields. Gaffron and Wohl postulated that in photosynthesis several thousand chlorophyll molecules acted together in light absorption, and the line of argument they took was very similar to the thrust of the Three-Men paper. Eventually, Gaffron and Wohl’s proposal paved the path for a completely new conception of photosynthesis, which developed in the course of the following years and which was one of the important roots of twentieth-century biophysics (and bioenergetics). However, the first reception of the concept was hardly enthusiastic. One of the most ardent critics was James Franck, who refused to accept the existence of a hitherto unheard-of mechanism of intermolecular energy transfer. This paper argues that, in order to understand the ensuing debate and its implications, the main actors’ “investigative pathways” (Holmes 2004) have to be taken into account, as well as their geographical migration from the Berlin context to the United States in the 1930s.

Author: Sylvia Nickerson

Title: Publishing Britain’s Scientific Sphere: Macmillan and Co. as Publishers of Science, 1860-1890

Abstract: In today’s age of Facebook, Twitter, and Instagram, it may be easy to forget that social networks, or social networking, existed long before social media. Historians of British Victorian science such as Susan Cannon and Ruth Barton have identified social networks and assessed the power and influence that such groups had. The point of such analyses has been to assess how the coordinated activities of individuals have influenced the changing practices and belief systems of Victorian science. This paper seeks to analyze the influence of British publishing company Macmillan and Co. on the intellectual currents of Victorian science. Alexander Macmillan, the head of the company during the 1860s and 70s, was a node around which a set of British intellectuals and culture makers organized. After opening a London office in 1858, Macmillan convened weekly social gatherings called the ‘Tobacco Parliaments’ that brought together men of science, artists, and writers of fiction. T. H. Huxley, William Sharpey and Herbert Spencer were regular attendees. Using internal documents from Macmillan’s nineteenth century operations, this paper explores how Alexander Macmillan’s network of friends and acquaintances embedded their influence within the list of Macmillan’s publications from the 1870s, 80s and 90s. Macmillan and Co.’s choice of authors, publisher’s readers, and scientific publications ultimately reflected Alexander Macmillan’s social network.

Author: Antonine Nicoglou

Title: From Norm of Reaction to Phenotypic Plasticity: The Importance of Anthony Bradshaw’s Work for Understanding the Evolution of Genotype and Environment Interaction

Abstract: The writings of the plant ecologist Anthony Bradshaw, published in the mid-1960s, have been particularly influential in the development of evolutionary ecology. His theoretical work has changed the way biologists use to see “phenotypic plasticity” – the ability of an organism to respond morphologically, physiologically or behaviorally to the changes in its environment – and it has also changed the way breeders use to consider the problems of genotype and environment interaction. Before him, this interaction was mainly seen through the “norm of reaction” model – the sum total of all the possible phenotypic curves expressed for a same genotype submitted to changing environments (Woltereck 1909). From now on, the norm of reaction was redefined as a phenotypic function which represents the multiple varying reactions determined by a genotype interfering with the totality of all incident (environmental) factors (Johannsen, 1911); the “norm of reaction” gradually becoming synonymous with the concept “genotype” (Dobzhansky, 1955).

Author: Kristian Hvidtfeldt Nielsen

Title: Interdisciplinarity in Mission-Oriented Military Research: The Case of US Military Research Activities in Greenland during the Cold War

Abstract: While the roots of interdisciplinarity can be traced to the advent of modern science, it is commonly agreed that

interdisciplinary research really took off after World War II. In particular, interdisciplinary research programs were integral elements in the shaping of US postwar foreign policy. The emerging military-industrial-academic complex relied on a host of established disciplines to launch its mission-oriented programs. This paper studies interdisciplinary research programs conducted in Greenland during the Cold War. Located between the USA and the USSR, Greenland was of the highest strategic interest to the superpowers during the Cold War. The development of a US polar strategy around 1950 called for a massive build-up of US military capacity in the Arctic region in order to build a “fortress of defense” against the Soviet Union. This military activity demanded new knowledge on many levels and from many different disciplines. The 1950s saw research camps built across Greenland, and hundreds of scientists pursued systematic research in fields including glaciology, geology, meteorology, ionospheric research, and psychology. The interdisciplinary nature of the military research programs seems obvious. Yet, the extent to which interdisciplinarity as such was ever discussed, or even articulated, as resource and/or as a problem by military officers and scientists remains understudied and will receive particular attention.

Author: Agusti Nieto-Galan

Title: Starving in a Science Pavilion. Giovanni Succi Challenges Doctors’ Authority at the 1888 Barcelona International Exhibition

Abstract: This paper describes how, in the heart of the 1888 Barcelona International Exhibition Barcelona, hunger artist Giovanni Succi (1843-1918), stayed for 30 days in public fasting in the Science Pavilion (Palacio de Ciencias). Succi’s extraordinary capacity of resistance to inanition was carefully supervised by a local medical commission, but he was also under the control of local and foreign journalists, students of the Faculty of Medicine, and other persons broadly interested in the ‘progress of physiology’. Beyond the restricted area of the exhibition, Succi also contrasted the authority of his performance in other sites: he practiced gymnastics, horse riding, urban walks, and swordplay as a public demonstration of his perfect health condition day after day. Controversies on the ‘real’ causes of Succi’s resistance to inanition soon arose among the local medical community. In that local context, unlike it had happened in other cities – in Europe and in the US - in which Succi performed his fast, homeopathy played a significant role in the construction of a convincing medical discourse for that exceptional episode. A detailed analysis of doctors’ experiments and arguments on Succi’s fast in Barcelona will shed new light on the way in which these kind of public performances shaped the nature and status of late nineteenth-century nutrition science. It also contributes to recent historiographical trends which, beyond academic settings, laboratories and hospitals, focus on the heterogeneity of medical practices and their circulation in new sites and specific local contexts.

Author: Alfred Nordmann

Title: Similarities – What Chemistry Brings to the Philosophy of Technoscience

Abstract: Ursula Klein entitled her portrayal of an alchemical laboratory «Technoscience avant la lettre». According to Bernadette Bensaude-Vincent and Jonathan Simon’s *Chemistry – The Impure Science*, nanotechnology is evidence that chemistry never ceased to be alchemy. These claims take a daring leap from pre-modern to contemporary research practice. For Klein, the common denominator lies in the practical orientation of research and the mobilization of research technologies, whereas Bensaude-Vincent and Simon refer to the persistent ambition to effect transmutations of matter. Another way to make sense of chemistry as technoscience ever since alchemy is to consider the role of similarity in chemical reasoning. On most conceptions of modern science similarity plays a heuristic role, at most, in science. The correctness of theories and models consists in the agreement with measurements of their predictions and not in any similarity between the model and reality. Indeed, as Christoph Meinel has shown, this is how molecular models were considered in the 19th century: They were crutches for the understanding but not to be taken to be similar to actual chemical structures. Against this empiricist attitude of a physicalist and high modernist chemistry, there is the current practice of inferring the availability and correctness of explanations from the similarity of experimental and calculated images, e.g., of the visualization by way of probe microscopy and the visual output of a simulation model. The presentation will consider this practice but highlight also its distinctness from alchemical reasoning and thereby the significance of chemistry for a philosophy of technoscience.

Author: John Norton

Title: Einstein as the Greatest of the Nineteenth Century Physicists

Abstract: Modern-day writers often endow Einstein with a 21st-century prescience about physical theory that, it just so happens, is only now vindicated by the latest results of the same writers’ research. There is a second side to Einstein. His science, methods and outlook were also clearly rooted in 19th-century physics and 19th-century thinking. His work on general relativity was powered by taking the mathematical advances of the 19th century and applying them to gravitation. By

contrast, quantum theory required the development of new mathematics as summarized, for instance, in von Neumann's famous 1932 book on quantum mechanics. Einstein's work on his unified field theory continued its reliance on the mathematical methods native to general relativity.

Author: Marcy Norton

Title: Mestisaje and The Royal Society

Abstract: Despite the recent surge of interest in Iberian and colonial science, this paper will argue that we have still not sufficiently appreciated the degree to which early modern science was indebted to mestisaje and Amerindian cultural formations and actors. The case study will investigate these themes through a close analysis of *The Ornithology* of Francis Willughby (London, 1678), a canonical text in the history of the biological sciences, often credited with anticipating Carl Linnaeus' classification system. In particular, the paper will focus on the way that this natural history produced by two members of the Royal Society became a vehicle for the Amerindian category of "iegue" (a Carib term meaning a tamed companion animal). *The Ornithology* also transmitted native Mesoamerican and Tupinamba knowledge about fauna through, respectively, the writings of the sixteenth-century Spanish physician Francisco Hernandez and the seventeenth-century Dutch naturalists Willem Piso and George Marcgrave. Moreover, the paper will argue that affective relationships between humans and animals were central to early modern natural history, as well as later zoology.

Author: Douglas O'Reagan

Title: Know-how and International Transmission of Industrial Science in the Cold War

Abstract: The emergence of the Cold War coincided with a marked increase in attention paid by businesses - and subsequently, by the law - to the importance of 'know-how' in communicating industrial science and technology. Efforts to extract German science and technology in the occupation years had impressed upon the businessmen and government officials involved the difficulty of communicating industrial science exclusively via written reports, and they increasingly came to see tacit knowledge - or 'know-how,' as it was more often called - as a vital component. This talk will examine the ways in which this changing perception of technology transfer and scientific communication shaped postwar diplomacy and international law, leading to such efforts as the American Economic Cooperation Administration bringing British, French, and other allied businessmen to reside in the US for weeks-long trips in an effort to boost these other nations' economies - and knit the Western alliance more closely together - by transmitting American 'know-how' abroad. This also directly informed international development efforts, starting with Truman's Point Four program, which were intimately tied to Cold War diplomacy. Between these state-led efforts at development, the rise of multinational corporations aiming to transmit their research across the globe, and a number of other factors I will address, I will argue that the networks for communicating industrial science across state borders during the Cold War were built fundamentally around person-to-person contact and tacit knowledge - that is, around 'know-how.'

Author: Jessica O'Reilly

Title: New Knowledge in Climate Assessments

Abstract: The Intergovernmental Panel on Climate Change (IPCC) produces scientific assessments of recently published, peer reviewed research. Their aim is to provide "policy relevant science advice" by organizing existing research in a way that is both comprehensive and comprehensible. This paper analyzes the production of knowledge in IPCC assessment reports, particularly taking up the question: do the IPCC assessment reports produce new knowledge? While the IPCC officially claims that they simply assess knowledge already generated elsewhere, our research suggests that new knowledge is generated through the assessment process itself, both in a technical sense (by making data published in various venues commensurate with each other) and in a social sense (through the authorship work of communicating science in a report). By examining the various arguments in favor and in opposition to the claim that the IPCC produces new knowledge, we suggest that there are several epistemic projects occurring within and on the sidelines of the IPCC assessment process. We consider what is at stake in these various epistemic projects, and the cultural work that these projects do in maintaining discursive boundaries between scientists, policymakers, contrarians, media, and "the public."

Author: Kelly O'Reilly

Title: “Doctor-less Birth Control”: Bringing Birth Control to California's Migrant Workers, 1939-1942

Abstract: In February 1939, Mildred Delp, a registered nurse, left her job in Indio, California, and set out on a journey with a single-minded mission: to promote birth control among the state's migrant women. Margaret Sanger, legendary birth control activist and then the chairman of the Birth Control Federation of America (BCFA), had just hired Delp as an itinerant nurse for the organization. Over the next three years, Delp traveled throughout California and Arizona, educating both migrant women and the social workers who dealt with them in the importance of birth control. My paper will track Delp's project and explain its significance to our understanding of the birth control movement. Delp's work highlights the complex relationship between the birth control movement and eugenic thought. At the national level, a number of prominent eugenicists wielded influence within the birth control movement. However, Delp herself was motivated less by a eugenic ideology than by a New Deal philosophy of the rehabilitation of the poor. In order for her efforts to be successful, Delp had to convince social workers of the importance of her work, thus placing birth control within a larger discourse of social work during the New Deal. In this dialogue between birth controllers and social workers, we can glimpse the beginnings of a new justification for birth control—one that posited birth control as an important step towards economic rehabilitation, and, subsequently, full social citizenship.

Author: Brian Ogilvie

Title: Digital Archives of Science

Abstract: Historians are increasingly working with material that is not only digital but has been digitized. My contribution examines the nature of archives in this age of digitization. Early digitization projects aimed to encode data for systematic analysis; on the other hand, more recent projects have sought to reproduce unique archival material in a manner that allows for open-ended historical inquiry without the need to travel to archives and manipulate physical objects. Such projects have undeniable benefits for historians who may lack the time or resources to travel, and for fragile objects that can be protected from wear and damage. Yet the digitized archive also raises questions and challenges. Who decides what to digitize, and who funds the activity? Physical archives already embody the values instilled in their creation and maintenance; what new valences are taken on when they are digitized? When institutions preserve material that they do not own, how do they balance the ease of access that digitization permits with some owners' interests in restricting access? Which aspects of the physical archive are lost in digitization, and do they matter? I will raise these questions through case studies of a few digital archives, with the aim not of resolving them but of opening up a discussion.

Author: Jesper Oldenburger

Title: Sheep and Artificial: A Failure to Innovate

Abstract: Slowly but surely Dutch cattle and pig breeders adopted the new technique of artificial insemination (AI) after the Second World War. Initially introduced as a tool to prevent the spread of reproductive diseases, breeders eventually saw the potential of AI to transform their practices. The possibility of using the semen of only the best animals and, perhaps even more importantly, of determining, through large scale prodigy testing, which animals consistently pass on their best characteristics, changed the way cattle and pigs were bred. It comes as no surprise that the possibilities of AI for the breeding of sheep were also explored. Despite the similarity in main goals, basic approach and potential success, artificial insemination never really caught on among Dutch sheep breeders. This was certainly not due to a lack of trying: from the 1960's onwards Dutch scientists organized, sometimes even in collaboration with breeders, several large scale experiments with the aim of popularizing AI among sheep breeders. This paper explores the question of why the technique of AI never became popular among the Dutch breeders of sheep between 1960 and 2000. Furthermore, the fact that Dutch scientists during these years continued to try to sway the breeders in using AI, while the breeders continued to be uninterested, makes this case study particularly interesting for obtaining a better understanding of scientific innovation in an agricultural setting.

Author: Pietro Daniel Omodeo

Title: Secundum quid and Determined Necessity in Scholastic and Early Modern Mechanics

Abstract: The concept of heaviness secundum quid had a powerful explanatory function in medieval science of weights, as for instance in the Aristotelian *scientia de ponderibus* of Nemorarius, and in the Renaissance reflections on mechanics of scholars such as Tartaglia, Cardano, and Benedetti. According to the “determination” secundum quid, the dynamic tendency

of a body can be reduced or incremented depending on intervening constraints, as for instance mechanical ones. In this paper, I will argue that the very idea of a reduction *secundum quid* derives from a conception of nature regarded as the realm of contingency. Scholastic natural philosophers maintained that natural processes can reach only a certain degree of actualization of their formal determinations. The contingency of nature lies precisely in the fact that the “natural order,” which is in itself necessary, is realized only in part due to external constraints. I will argue that this conceptualization of nature as the realm of contingency—or as a *necessitas determinata* (that is, necessity “diminished” by impediments and constraints)—underpinned the explanations *secundum quid* in medieval and early modern mechanics from Tartaglia to Galileo. Moreover, I will show the persistency of this epistemological-ontological background in the mechanical treatments of cosmology and physics, and suggest that the Cartesian reflection on the laws of nature was structurally dependent on the post-Scholastic reasoning *secundum quid*—thus, on the ‘principle of contingency.’

Author: Tomoko Onabe

Title: Confrontation and Conciliation of the Chi (Energy) Tradition with Newtonian Particle Theory in Late 18th-Century Japan

Abstract: This paper examines natural scientific aspects of Chi imported to Japan to show the historical interpenetrations of Chinese and Western ideologies refracted through Japanese nascent modernization in 1780-1867. Chi (氣) is the Chinese system of energy and life that rules the physical universe as well as the metaphysical world. Although it was imported to Japan much earlier, in Edo Japan, Chi became the official concept for almost all academic subjects. Although some aspects of Chi were not fully understood or incorporated, Chi was imported basically without questioning to Japan. However, in the late 18th century, a Japanese scientific practitioner, Shizuki Tadao (1760-1806) faced a threatening theory for the first time--the popular interpretation of Newtonian physics. There was continuous friction as it was assimilated. In order to find a compromise between Chi theory and Newtonian particle theory, in his unique theory Shizuki first pursued consistency in the Newtonian theory by revising it as a kind of Chi. Yet the version of Newtonian theory introduced to Japan at this period, which was a popularized early version in John Keel's book, in itself entailed theoretical inconsistencies. Shizuki further summarized by himself that the particle theory inevitably leads to the conclusion that the refraction stems from the difference of attraction according to the materials through which the rays travel. Thus solving such complex of inconsistencies led Japanese to further revise the Chi concept as a fundamental principle.

Author: Lisa Onaga

Title: Tracing the Low-Dose Question in Japan

Abstract: A goal of the Fukushima Health Management Survey, in addition to monitoring and treating the health of the residents of Fukushima Prefecture following the 2011 Great Eastern Japan Earthquake and the associated nuclear disaster, is to determine whether long-term low-dose exposure to radiation will bear an impact on human health. This paper seeks to understand why that particular question about the low-dose has been paramount to Japan. The approach to the question of the effects of radiation exposure, especially following the outrage of the 1954 nuclear fallout incident in Bikini Atoll, pose great importance for recognizing how different models of low-dose effects, including the prominent linear no-threshold model, were jockeyed for credence in Japan while Japanese scientists themselves were maneuvering to gain recognition by the international scientific communities. I examine a 1960 roundtable on the state of radiation research in Japan published in the magazine *Iden* (Heredity), affiliated with the popularization organ of the National Institute of Genetics. Seven prominent geneticists convened to discuss matters of fallout, the food chain, dosimetry and the low-dose effect of radiation in relation to their practices of cutting-edge genetic research. This unusually frank discussion illuminates how basic researchers in this arena rallied about the low-dose topic with their mutation studies in lieu of returning to a fallout-free past.

Author: Naomi Oreskes

Title: Constructing, Honoring, and Breaching the Science/ Policy Boundary in Scientific Assessments

Abstract: The assessment of science for policy implies a boundary between the former and the latter, and scientists working on assessments work mightily to define, articulate and sustain that boundary. In our review of scientific assessments, we find that scientists work extremely hard, and consider it important to, articulate and honor a clear and well-defined boundary between science and policy, as they understand those domains; many express strongly the view that it is very important for them to stay on the “science” side of the perceived or theorized “science/ policy” boundary. However, we also find that scientists have divergent views on where this boundary lies, in some cases respect the boundary more in theory than in practice, and a small but significant (and arguably influential) minority believe, with Hamlet, that this custom is honored more in the breach than in its observance. This paper explores how scientists have viewed the boundary between science and

policy, what they consider to be at stake in constructing, respecting, and maintaining it, and how and why some have taken positions at odds with the dominant, majority view.

Author: Barbara Orland

Title: Artificial Fertilization in the Life Sciences of the 18th Century

Abstract: Today, the Italian Abbé and professor of natural history Lazzaro Spallanzani (1729-1799) is commemorated as one of the forefathers of modern reproductive medicine. In Wikipedia one can read that Spallanzani was the first to perform artificial insemination and even in vitro fertilization. His story is inscribed in a history of the medical treatment of infertile couples. This paper will take a look on the concrete circumstances that led Spallanzani and his contemporaries to undertake experiments with artificial fecundation (as it was called then). As will be argued, Spallanzani was neither interested in medical topics nor in the human body or questions of infertility at all. Instead, he was engaged, at a philosophical level, in the eminent controversies of the 18th century natural history surrounding the understanding of animal generation. Modes of impregnation, spontaneous generation, the vitality and behaviour of semen, ovum and uterus, and other issues were studied by fertilisation experiments. Hybridization, in concrete, supposed to be the most promising method to give answer to the so-called mule problem – the relation between the species. Only at the end of the century animal breeding gave the hybrid technology of artificial fecundation a value in itself. Crossbreeding experiments contributed to the spread of the economic idea to improve plants and animals, and even Spallanzani tried to make a series of hybridization experiments, without success. After a short phase of euphoria, things sobered up, and naturalists as well as most animal breeders lost interest in artificial insemination as a crossbreeding technology.

Author: Alberto Ortiz

Title: Measuring Bodies and Intelligence: Physicians, Psychiatrists, and Prisoners in Puerto Rico's Oso Blanco, 1930s-1950s

Abstract: Most Latin American societies witnessed the arrival of modern penitentiary science in the nineteenth century; in the Spanish Caribbean, this happened in the twentieth. The Insular Penitentiary at Río Piedras, Puerto Rico (popularly known as Oso Blanco) opened in 1933. As noted in the prison's inaugural code, U.S.-American and Puerto Rican officials made health and social science pillars of the new institution. Between 1933 and mid-century, when Oso Blanco faced a crisis of legitimacy, penitentiary science matured significantly while also justifying colonial and neo-colonial projects. Rooted in criminal anthropology and tropical medicine, Oso Blanco's reformatory program increasingly embraced psychiatry and social work during this period. Prison records covering these years suggest that the penitentiary functioned as a scientific laboratory, one that had at least a two-pronged mission. To regenerate and re-educate convicts, prison authorities believed that inmate bodies should be catalogued and studied by physicians first. After being physically diagnosed, psychologists and psychiatrists measured inmate intelligence to determine their prospects for release and societal reincorporation. Prisoners and medical personnel interacted in this world in scripted and complex ways. Inmates often reflected on the scientific attention and treatments they received. They also consulted other epistemologies to contend or to overstand Oso Blanco's evolving healing paradigms. This paper traces the footsteps of select physicians, psychiatrists, and prisoners not only to establish the shared production of empirical and intuitive forms of measurement, but also to gauge the depth of the intersections between them in Oso Blanco.

Author: Nicholas Overgaard

Title: Investigating the Holy Bodies of Men: Medical Disagreements about Physical Manifestations of Holiness in the Body at Rome, 1550-1620

Abstract: Following a break in canonizations between 1523 and 1588, the Catholic Church reformed its canonization procedures to include more empirically based evidence when justifying a holy person's elevation to sainthood. Physicians contributed to the reformed canonization process by conducting holy autopsies; that is, they investigated the internal organs of a recently deceased holy person for physical manifestations of holiness. Upon completion of the autopsy, rather than to the physician, it was left to the ecclesiastical authorities of the Church – theologians, cardinals, and the pope – to determine whether or not the discovered signs were genuinely miraculous. Although physicians seemed to have little interpretive input in doctrinal determinations of sanctity, they nevertheless demonstrated an interest in holiness by conducting medical investigations of holy bodies. My aim is to shift the attention of holy autopsies from providing evidence for sanctity in canonization trials towards providing physicians with an opportunity to posit their own claims about the holy body. By analyzing the medical texts in which physicians discussed the holy autopsies of two early seventeenth-century saints, Ignatius of Loyola – the first male subject of a holy autopsy – and Philip Neri and comparing them with trial proceedings, I argue that

physicians proposed their own medical explanations for corporeal signs of holiness which both differed from the conclusions of canonization trials and varied among physicians themselves.

Author: Kwon Soo Park

Title: Sliding under the Signifier, Insisted Meaning: The Concept of Air and Qi in the Literatures of China Jesuits and Joseon Literati from 17th to 19th Centuries

Abstract: This paper examines the interaction between the traditional concept of qi (ch'i 氣) and the new concept of air in the writings of the China Jesuits and Korean literati from the 17th to the 19th centuries. The traditional qi philosophy was fully enunciated in Neo-Confucianism, especially the teachings of Zhu Xi (朱熹 1130-1200). After Zhu Xi's time, the literati of China and Korea shared the terminology of qi philosophy and used the concept of qi in the Neo-Confucian context. In the early 17th century, the Jesuit missionary Matteo Ricci introduced the theory of the four elements and Aristotelian natural philosophy to China and criticized Chinese traditional theory of the five phases (wuxing 五行) and Neo-Confucian natural philosophy. Interestingly, he used the term qi to translate the Aristotelian concept of air. Subsequently, many Jesuits in China and Korean literati wrote about the theory of the four elements and compared it with the theory of the five phases. A space emerged in which the Aristotelian and Neo-Confucian natural philosophies met and interacted with each other. This paper highlights the conceptual confusions in both the Jesuit criticisms of the theory of the five phases and Korean literati's discussions of the four elements, especially concerning the relationship between qi and air. It argues that the confusion persisted until the late nineteenth century, when Korean scholar Choe Hangei 崔漢綺(1803-1877) created a more comprehensive theory of qi philosophy that integrated the Newtonian theory of gravity which he had first encountered in a Chinese translation imported into Korea.

Author: Karen Parshall

Title: Celebrating the American Mathematical Endeavor: The Semicentennial of the American Mathematical Society, 1938

Abstract: At least symbolically, the American mathematical research endeavor was fifty years old in the 1930s when European emigrés were resettling in the United States. An American mathematical research community centered on the activities of the American Mathematical Society (AMS) had, in fact, been founded in 1888 and celebrated its semicentennial in 1938 at a four-day-long gala held in September at Columbia University. Ten years (!) in the planning, it was a time of great fanfare and self-congratulation. Its sessions highlighted developments in, among other areas, algebra, differential equations, geometry, harmonic analysis, topology, and even the more muuapplied subfield of hydrodynamic stability. Almost all of them had boosteristic overtones and told largely triumphal stories, explicitly citing the work of their fellow Americans and heralding the research productivity and world-class accomplishments of the community defined by the AMS. This talk will analyze the mathematical and nationalistic agendas that played out in New York City in the early fall of 1938, while situating those agendas within the context of a mathematical community that had consolidated and grown in key ways in the 1920s and 1930s.

Author: Christopher Parsons

Title: Beyond Erasure: Pehr Kalm and Indigenous Knowledge in Eighteenth-Century North America

Abstract: Pehr Kalm arrived in North America in 1748, one member of an army of naturalists sent to the far corners of the globe at the behest of Carl Linnaeus. In his *En resa til Norra America* Kalm represented North America as virgin territory, a land where "not a single botanist had yet researched or carefully described the plants that are found there." Kalm's trip seems then to be a paradigmatic of the sort of colonial science recently studied by numerous historians - colonial in its location, colonizing in its ability to silence indigenous perspectives. Yet if it is true that the integration of Kalm's research into Linnaeus' global taxonomic system left little room for the perspectives or experiences of colonial and indigenous peoples, his own work was nowhere near so easily classified as an extractive enterprise. Indeed, as he travelled from Philadelphia and onto New France, he described a patchwork landscape shaped by colonial and imperial contact and clashes over the past 150 years. This paper will suggest that Kalm saw working with indigenous people as essential for understanding these entangled ecologies. Through the strategic juxtaposition of both narrative and scientific genres, the Swedish botanist introduced European audiences to both rooted indigenous knowledges and portable botanical specimens. This paper argues that histories of the erasure of indigenous participation in colonial science have overlooked far more subtle transmissions, and argues for a focus on the role of genre in preserving or erasing these traces of the indigenous roots of enlightenment science.

Author: Emily Pawley

Title: Coining Foliage into Gold: Genres of Scientific Storytelling and Mulberry Bubble, 1838-1839

Abstract: In the winters of 1838 and 1839, advertisements for the *Morus multicaulis* mulberry tree clogged the pages of American commercial and agricultural newspapers. With its vast, copious leaves, and its useful habit of sprouting wherever a cutting had been dropped, *multicaulis* promised a fast-growing wealth at a time when other forms of wealth had failed. Speculators in New York, Boston, Philadelphia and Charleston, dazzled by visions of an American silk industry, bought hundreds of thousands of trees to supply billions of anticipated silkworms. By November of 1839, however, *multicaulis*'s value would evaporate---by 1840 its name was a joke. How did an East Asian shrub, unknown to Americans until ten years before, accumulate enough concentrated belief to shape markets and ruin reputations? This paper shows how the reputation of *Morus multicaulis* rested on particular genres of scientific credibility: reports sent through global botanical networks, climate narratives, specimen exhibitions, and silkworm taste tests, as well as on mock accounts based on the *Morus multicaulis*'s remarkable reproductive capacities. Following the mulberry's track through these genres, and its movement from botanical curiosity to financial phenomenon, this paper reveals the ways that different kinds of scientific knowledge intertwined in the antebellum marketplace and illuminates the intersection between scientific and commercial forms of credibility.

Author: Trevor Pearce

Title: Weismannism Comes to America: Pragmatism and Evolution in the 1890s

Abstract: It is well known that the American pragmatist philosophers were influenced by evolutionary ideas in the second half of the nineteenth century, but scholars have only sketched the general outlines of this influence. My broader project is an attempt at a more detailed and chronologically specific reconstruction of the relationship between biology and pragmatism; unsurprisingly, the dominant issues of the 1860s were very different from those of the 1890s. In this paper, I focus on the latter decade — on the pragmatists' involvement with and reaction to the “factors of evolution” debates that followed in the wake of August Weismann's studies of heredity. The pragmatists participated directly in these debates. William James embraced Weismann's theories at the very end of his *Principles of Psychology*, published in 1890. Charles Sanders Peirce sparred with the biologist Henry Fairfield Osborn in the *New York Times* over the importance of Herbert Spencer's views and their relation to Weismann's. Peirce presented his own contribution to the “factors” debates in a series of articles in *The Monist* from 1891-93. Finally, John Dewey opposed what he called “extreme Weismannism,” and referred in several places to the famous 1893-95 debate between Weismann and Spencer. He ended up seeking a compromise between spontaneous variation and environmental control in evolution. Placing the pragmatists' 1890s work in the context of debates in biology allows us to understand why certain topics — different modes of evolution in Peirce's case, organism-environment interaction in Dewey's — were central to their philosophy.

Author: Sharrona Pearl

Title: Facial Transplants: Decoding the Debates

Abstract: This talk explores the bioethical debates and media maelstrom surrounding the first face transplant of Isabelle Dinoire in 2005. I'll decode these debates, arguing that they rest on a misrecognition of the surgery as “only cosmetic,” ignoring the very real therapeutic value of the surgery in the risk-benefit calculation. Through a close reading of the bioethical, medical, and journalistic literature on the topic, I demonstrate that objections to the surgery rested on both this misrecognition and a very real -- and very covert -- fear of identity transfer. I'll discuss the force of the objections and offer some analytical and theoretical reasons why they dissipated. At its core, this is a talk about the tremendous power vested in the face, in the link between appearance and identity, in our investments in how we look and how others look. And this is a talk about how much we fear changing the rules that govern visual judgment. This hearkens back to very old beliefs in physiognomy, in the idea that the face is an index to character. The facial allograft surgery lays bare our hidden beliefs that this index – the face – ought to be an accurate one.

Author: Neil Pemberton

Title: A Mortuary with a View: The Crumbles Bungalow Murder and the Spectacle of Interwar English Homicide Investigation

Abstract: Focusing on English homicide investigation in the mid-1920s, this paper explores the vicissitudes of expert

authority and knowledge-claims involved in the creation, harvesting and management of a crime scene, its public imaginings, and its interpretation and articulation in the courtroom. My discussion examines the 1924 murder of Emily Kaye, a pregnant woman, by Patrick Mahon in an Eastbourne beach bungalow. At the centre of the case was a dismembered and mutilated body, whose remains were embedded within and scattered across the material fabric of the holiday cottage. My line of argumentation will be two-fold. First, I will examine how the gruesome case not only gained notoriety in the public imagination but also it marked a watershed moment that, in many respects, heralded the arrival of our present-day, trace-centred model of “Crime Scene Investigation” (CSI). In showing this, I will map how police investigators, physically and imaginatively, constituted the Crumbles Bungalow as a “crime scene”, elaborating a public template of what a modern forensic investigation should like, including: systematic searching and recording and the creation of a chain of custody. Secondly, I will argue that despite being projected as a spectacular case that brought English CSI into being, the public imaginings of the investigation, paradoxically, positioned the singular authority of the ‘body-centred’ pathologist as the exemplary expert most publicly associated with the modern culture of CSI, rather than trace-orientated practices of police detectives. As I will show, this obfuscation performed significant cultural work, the unpacking of which reveals the historical contingencies shaping the contexts and factors that influenced the historical development of, and the emerging public expectations about, the analytical and investigatory powers of CSI in interwar England.

Author: Cheryl Periton

Title: The Medieval Counting Table

Abstract: This poster will illustrate the history and use of the medieval counting table, using examples from books such as 'Ground of Artes' to demonstrate the ways in which those of even limited arithmetical knowledge could accurately perform calculations.

A second strand will consider the use of the table to undertake calculations involving English money (£, s, d) and hence not using base 10.

Author: Marissa Petrou

Title: Defining Work, Picturing Gender: German Visual Anthropology of Late Spanish Colonial Philippines

Abstract: The late Spanish Colonial Era of the Philippines witnessed a growing community of middle-class, educated, revolutionary-minded Indios who sought to return to the vibrant pre-colonial economic activity of the Philippines in East Asia. For ideological support, these Illustrados turned to the research of German field anthropologists on labor practices and products. For physical anthropologists, knowledge of gender-based labor practices was essential to skull identification and thus the study of human variation. Cultural anthropologists studied labor practices to understand gender roles and social relationships. Yet anthropological practices were themselves gendered. This paper will examine the activities, spaces and peoples identified with the concept of work in German physical and cultural anthropology of the Philippines. In Germany, the state-funded public museum and its middle-class donors sought to attract and educate the working-classes. Trade companies had their own notions of work, which involved the recruitment and migration of laborers across the colonies. I consider gender from three different perspectives: labor as a subject of study, technologies of fieldwork, and technologies of analysis. I apply a methodological framework from STS literature on gender and postcolonial studies (Harding, 2011; Seth, 2009) to analyze the role of photography in constructing gendered notions of labor of the scientist and his subjects of investigation.

Author: Christopher Phillips

Title: Cause by Number: Jerome Cornfield and Statistical Narratives

Abstract: Jerome Cornfield (1912-1979), a pioneering statistician at the National Institutes of Health and the U.S. Bureau of Labor Statistics, helped establish the role of mathematical models in causal narratives of disease and health. Physicians had traditionally resisted the use of statistics in favor of the role of trained judgment about relevant individual difference: patients want to know if they will get better, not if the average person will. Furthermore, a long philosophical tradition had maintained that narratives of physical causation relied on different epistemic grounds than did the conclusions of mathematics; many formally trained statisticians were leery about blurring the lines between correlation and causation. Cornfield challenged this conventional wisdom by pushing the federal government to recognize the ability of statistics to reliably establish causal narratives, most famously in the landmark 1964 report linking smoking to lung cancer. An historian and economist by training, Cornfield not only positioned mathematics as a powerful tool for telling cause-and-effect stories, but also re-introduced Bayes' Theorem into mainstream statistical practice. Although he remains largely unknown outside the fields of biostatistics and statistical epidemiology that he helped establish, his work would lay the intellectual foundations for

the potential of mathematical inferences from “big data” to be applied widely. As this paper demonstrates, his trajectory to the presidency of the American Statistical Association reveals not just the changing status of applied mathematics over the twentieth century but also the ways mathematical methods increasingly provided a basis for new kinds of causal narratives.

Author: Nicholas Popper

Title: Archives and the History of Collecting

Abstract: I intend to situate the emergence of early modern scientific and natural philosophical archives within contemporary practices of preservation. As historians of science have long acknowledged, emphasis on compilation and preservation was central to many forms of early modern knowledge-production. This attitude towards the accumulation of evidence underlay the philosophical emphasis on empiricism, the formation of spaces like wunderkammern, the persona of the expert, and technologies such as scientific notebooks. This work, however, has rarely been coordinated with other recent scholarship that has revealed that preservation and archiving were as ascendant in early modern history, politics, and law as in natural philosophy or astronomy. For example, recent scholars of political culture have argued that the sixteenth century witnessed the intensifying production and preservation of records of political interactions, both in official state archives and in private collections. I intend to integrate these narratives of increasing compilation and preservation. As I will suggest, the intellectual terrain of early modern Europe would best be described as a vast, entangled ecosystem through which washed numerous practices of making knowledge, pooling or coagulating in cultures of learning according to local channels and contours, and unencumbered by disciplinary boundaries. Tracing the path traversed by archival practices will illuminate the reconfiguration of early modern natural knowledge and its relationship to other cultures of knowledge. At the same time, I will suggest that doing so enables historians of science to broaden their emphasis on practices of knowledge-production to other spheres of early modern scholarship.

Author: Maria Portuondo

Title: Finding “Science” in the Archives of the Spanish Monarchy

Abstract: My contribution to the roundtable discussion derives from a curious episode in the history of science in Spain. During the late eighteenth century a young navy officer, Martín Fernández de Navarrete, was dispatched to all the principal archives of the Spanish monarchy with a peculiar mission. He was to search for evidence that the Spanish had, in fact, a scientific tradition, and using what he found prove that as a nation Spain was not, as the French and English were in the habit of saying, completely divorced from these pursuits. I will comment on the outcome of Navarrete’s mission, the role his project has on the historiography of the history of science in Spain, and more generally, reflect on the many curious uses of state archives by historians of science, then and now.

Author: Greg Priest

Title: Charles Darwin’s Theory of Moral Sentiments: What Darwin Really Borrowed from Adam Smith

Abstract: Charles Darwin’s *Origin of Species* teems with economic language. Organisms are in “competition” for resources. They organize themselves into an “economy of nature” characterized by a “division of labour.” It is therefore unsurprising that the *Origin* has often been read as an apologia for the economic system and established morality of Darwin’s England. Adam Smith and other architects of the Scottish Enlightenment, so the narrative goes, had developed theories of political economy that supported laissez-faire economic policies and social arrangements. Darwin borrowed those social theories and refashioned them into biological facts, and so put Victorian economic and moral arrangements on a scientific footing. It is a compelling narrative, but it does not hold up. There are profound affinities between Darwin’s and Smith’s thought, but Darwin did not borrow his “economic” ideas from Smith. More fundamentally, the narrative completely ignores the one idea that Darwin unquestionably did borrow from Smith—the notion that human morality is grounded on an innate “moral sentiment.” And Darwin built on that foundation a theory of morality that undermined, rather than supported, any claim that science provided a foundation for laissez-faire capitalism and Victorian social mores. Darwin believed that there can be no absolute grounding for moral principles—that such principles are, rather, evolved attributes of social organisms. On Darwin’s evolutionary account of morality, a principle can have moral force only for the specific lineage of organisms in which it evolved. Smith’s influence on Darwin was thus quite different than is commonly supposed.

Author: Alicia Puglionesi

Title: "A Ghost-Catching Weather Bureau": Psychical Research and Meteorology in Nineteenth-Century America

Abstract: The scientific enterprise of studying the weather bore a striking resemblance, in the eyes of many nineteenth-century investigators, to the study of the mind. At least, those attempting to raise the scientific clout of psychical research in the 1880s and 1890s linked their project rhetorically and methodologically with that of organized meteorology. Their object of investigation was vast and diffuse, its phenomena fleeting. Like the weather, the human mind as a dynamic, complex system could not be viewed in its entirety by any single individual. Rather, an army of amateur foot-soldiers was needed to observe and record its manifestations. Psychical researchers sought to build a network of data-collection modeled on that of the United States Weather Bureau and the amateur observational networks that preceded it (and which still contribute to the production of meteorological knowledge today). This association between the weather and the mind was not merely a rhetorical tool for psychical researchers struggling to bring legitimacy to a set of practices derided as "ghost-catching" and rejected by many academic psychologists. At the core of the analogy was a conceptualization of the mind as a natural object at odds with the mechanistic model which would dominate American psychology in the twentieth century. My dissertation explores the lives and afterlives of psychical research in America. My presentation at HSS will incorporate the correspondence of amateur researchers to develop an argument about the experiential significance of the mind-weather analogy, in addition to establishing its methodological and rhetorical uses in turn-of-the-century scientific debates.

Author: Lewis Pyenson

Title: The High Horizon: Science and Art in Argentina

Abstract: In 19th-century Argentina, the recording of the natural world (biota, land, skies) followed a European model, just as painting did. Until the last quarter of the twentieth century, Argentine scientists and artists adopted, sometimes brilliantly, European innovations without much variation. Argentine sensibility in science and art is nevertheless found in general traits rather than in particular propositions. Argentine scientists are strongly attracted to literature and the arts, where they not infrequently devote much of their attention. A notable example of this confluence is Ernesto Sabato, a physicist trained under Joliot-Curie in Paris who became a novelist and painter and who chaired the 1983 Commission on the Disappeared (CONADEP), which, in form, resembles a scientific paper in the Modern Age.

Although painting in Argentina shows great diversity, continuities are present across many of the distinct styles. One striking characteristic, in landscapes and cityscapes, is a high horizon (compared to traditional Netherlandic or Romantic landscapes). A second characteristic concerns multiplicity of people engaged in activity that is either futile or idle. In Argentine literature, a recurrent theme concerns strong-willed, if unreflective people who are pushed aside by events they do not understand. Ernesto Sabato engages the theme when he writes about blindness in his novel, *Sobre héroes y tumbas* (1961). Examples of art shall be drawn from the remarkable collection of 20th-century painting and sculpture in the halls of the National Commission of Atomic Energy.

Author: Sean Quinlan

Title: Liberating the Inner Self: Heightened Sensibility, Intuition, and Imaginative Expression in the Philosophy of Maine de Biran

Abstract: Historians and critics have often identified philosopher Maine de Biran (1766–1824), who famously bridged sensationist and neo-Kantian theories of mind and body, as one of the main figures who pioneered substantial debate on the self and "interior experience" in post-revolutionary intellectual circles. Drawing upon Biran's extraordinary journals and posthumous publications, this paper analyzes how he explored the interrelations between heightened sensibility and intuition in the making of the creative imagination. Here Biran posited that aesthetic expression developed in a dialectic between neurophysiological states, on the one hand, and independent volition and concentrated effort, on the other. In this process, the paper argues, Biran drew upon key biomedical debates, as circulating in hospital clinics and scientific academies, about the relation between will and sensibility, especially as revealed in heightened states associated with intellectual absorption, dreaming, somnambulism, ecstasies, and hysteria. In Biran's view, these states originated from what Xavier Bichat had called "animal life," and he concluded that individuals must first engage and then master these states, honing the inner concentration and self-reflection they needed to discover an authentic imaginative vision. Unlike J.-J. Rousseau and the Marquis de Sade, then, who in different ways sought to locate a more "natural" expressivity, Maine de Biran ultimately suggested that individuals must transcend biological materiality, discovering the authentic "inner self" that could liberate the mind's creative vision.

Author: Aleta Quinn

Title: William Whewell, Historical Scientist

Abstract: In this paper I explicate William Whewell's attempts to ground a new science of historical architecture in his 1830 *Architectural Notes on German Churches*, a work that has received scant recent attention. Whewell's work represents a previously under-recognized source for the original formation of methodology of historical science. I show how Whewell's own historical architectural work exemplifies his philosophy of the historical (palætiological) sciences. I distinguish between historical dependence relations and direct property relations, each of which obtains between facts. On Whewell's view, historical scientists hypothesize both kinds of relations in developing a theory of historical facts, and *Architectural Notes* follows this description. For Whewell, historical science is not a matter of hypothesizing any single series of past events, but rather theorizing facts that constrain what must have happened. Whewell's views illuminate the roots of the 20th century philosophical view that the historical sciences concern particular facts, and are thereby distinguished from the experimental sciences, which concern universal laws. I conclude by illustrating Whewell's philosophy of the historical sciences by contrasting methodology in biological classification before and after Darwin. Whewell was on friendly terms with Darwin, who took himself to be reinterpreting classification as a historical science, and I suggest that Whewell's historical scientific work influenced Darwin's views on biological classification.

Author: Sadiah Qureshi

Title: Doomed to Die: Endangered Races, Science and Modern Settler Colonialism

Abstract: Lamenting the predicament of dying races became an increasingly prominent occupation in the long nineteenth century. Novelists, painters, scientists, politicians, poets, travel writers and missionaries all contributed to creating and perpetuating the sense that some peoples were doomed to a speedy extinction. Early-modern writers had long noted the apparent decimation of some indigenous peoples; however, such discussions took on a new and urgent form in the nineteenth century as commentators were increasingly able to appeal to a new scientific understanding of extinction as an endemic feature of natural change. For example, in 1871, Charles Darwin's *Descent of Man* naturalized extinction as a feature of intercultural contact arguing that it followed "chiefly from the competition of tribe with tribe, and race with race." This talk will explore how a history of human endangerment might be of importance for broader histories of the relationships between scientific knowledge, political policy-making and the nature of intercultural contact within settler colonies.

Author: Megan Raby

Title: Landscapes of Leisure or Labor? Making Places for US Field Biology in the Caribbean

Abstract: At the turn of the twentieth century, American biologists rode a wave of U. S. expansion into the Circum-Caribbean, establishing new institutions for the study of tropical plants and wildlife. A long-standing historiography supports the role of biological stations in the development of a community of biologists within the U. S., and the relationship of biological fieldwork to cultures of labor and leisure. Field research stations like Cinchona, Jamaica; Soledad, Cuba; and Barro Colorado, Panama, were not merely transplanted American institutions, however. Not only did American biologists grapple with the unfamiliar environments of the tropics, encounters with profound differences in the societies and labor structures of Caribbean countries shaped the institutions and practices of American tropical science. American researchers exploited growing Caribbean infrastructures of trade and tourism, while developing their identities as tropical biologists in tandem and tension with that of the nascent "Caribbean tourist." The laborers who kept research stations operating year-round derived from existing workforces—from the ranks of plantation field hands and canal builders. U. S. biological institutions adapted local labor and racial hierarchies—drawing at least as much from these for their daily operation as from the traditional institutional structures of stations in the U. S. and Europe. This could offer unparalleled opportunities for control over scientific space, but it also heightened stations' risk in times of labor upheaval. This paper examines the structure and meaning of scientific work in the diverse and sometimes volatile contexts of the twentieth-century Circum-Caribbean.

Author: Evan R. Ragland

Title: Trying Medicine in the Historiography of Early Modern Experiment

Abstract: Despite the acknowledged significance of the widespread practice of sustained experimentation in the seventeenth century, our current historiography is far from a consensus view on its emergence and development. This paper presents

novel evidence from sixteenth-century medicine, especially Italian natural history, chemistry, and anatomy, to argue for the widespread adoption of ‘making trials’ of natural phenomena in leading universities. The testing of drugs in the late-fifteenth century elaborated on medieval drug trials, which displayed sophisticated procedures and some engagement between the particular and the universal. In the sixteenth century, anatomy, natural history, and chemistry, in particular, were areas of vigorous empirical inquiry. From Berengario and Vesalius to Fabricius and on, anatomists tested ancient and contemporary claims with contrived, singular trials. While medieval investigations in optics, medicine, alchemy, and artisanal traditions involved limited uses of experimentation, sustained experimental series seem to appear across Europe only in the early modern period. Sixteenth-century medical pedagogy and printing might help to explain the new popularity. The concentration of students from across Europe in these pedagogical centers, combined with the prodigious print runs of medical texts and the necessary interaction of theory and practice, might help us to understand how forms of speech and performances of artificial trials came to be used across early modern Europe. Finally, this paper offers some preliminary suggestions for situating these sixteenth-century practices in our current historiography, placing physicians among artisans, mixed mathematicians, engineers, musicians, women healers, and philosophers.

Author: Christina Ramos

Title: Madman or Heretic? The Inquisition and the Uses of a Madhouse in Colonial Mexico

Abstract: In the late eighteenth-century, the Hospital de San Hipólito, New Spain’s oldest public institution for the mad, located in Mexico City, became the primary receptacle for insane criminals who had fallen afoul of the Inquisition. These prisoner-patients had either committed a religious offense in the grips of insanity or, equally common, they had lost their wits during their imprisonment while awaiting trial or sentencing. This paper draws on Inquisition cases to examine the hospital’s role in mediating debates about madness within the inquisitorial context. In particular, it shows that inquisitors utilized this institution less for the purposes of social disciplining than to resolve pressing questions about the nature of a suspect’s internal state: was his madness real or feigned? was he drunk? simple-minded? demonically possessed? In committing suspects to the colony’s mental hospital for the purposes of resolving these issues, inquisitors effectively transformed its function from a charitable institution dedicated to the care of mad paupers into a colonial laboratory for which to scrutinize the authenticity and progression of symptoms.

Author: Jennifer Rampling

Title: Alchemy between City and Cloister: Poetry, Blackmail, and Expertise in English Religious Houses

Abstract: Thomas Ellys, the last Prior of Leighs, little suspected that his interest in alchemical books would eventually land him in court. Anxious to put his reading into practice, this Tudor churchman recruited a clothworker and self-styled adept, Thomas Peter, to visit Leighs Priory and teach him alchemy – the first step in a series of unfortunate events that also involved a London goldsmith, a priest, an attorney-at-law, and the future Bishop of Worcester. These conjunctions generated new books and correspondence, in which Ellys and his network sought to extract practical information from medieval texts, including English alchemical verse.

In this paper, I shall argue that collaboration between city and cloister may have been much more common than previously supposed. Religious houses offered secluded sites for alchemical practice (technically illegal in England since 1403), as well as opportunities for further funding and patronage which secular practitioners were able to exploit. These interactions reveal the attempts of fifteenth- and sixteenth-century alchemists to interpret their textual sources – obscure alchemical poems and treatises – in light of practical knowledge, including techniques acquired in other crafts or “bought in” from outside experts. In their own writings, secular alchemists also adapted the style of their clerical authorities for use in patronage suits. The result is the earliest surviving evidence to connect actual English practice (as testified by court records) to specific procedures described in treatises: a link that sheds new light on the little-known world of pre-Reformation alchemical practice and expertise.

Author: Alisha Rankin

Title: Poison Trials and the (Mis?)Communication of Experiments in Sixteenth-Century Europe

Abstract: A number of prominent trials of poison antidotes took place across Europe in the sixteenth century. These trials always involved giving a dose of poison to a test subject, followed by an antidote, to see if the antidote worked. Test subjects were often animals, especially dogs; in addition, between 1524-1581 a handful of trials were conducted on condemned criminals. Reports of these trials on humans and animals were circulated around Europe in letters, printed medical and

botanical books, and in drug advertisement literature. Although poison trials were often portrayed as definitive tests of an antidote's worth or worthlessness (or, in some cases, the strength of a poison), they conveniently tended to support a given author's existing position. This paper examines reports of several poison trials and questions what exactly the communication of such trials was meant to convey. Were trial reports accurate experimental accounts, as they would seem to be if taken at face value? Were they intended to communicate results that could be put into practice? Or were they polemical papers that underscored a particular position or an antidote? The example of poison trials allows us to see the manipulability of singular events in the increasingly experimental climate of sixteenth-century European science and medicine.

Author: Carmel Raz

Title: "The Harmonium Within Us": Ether, Ethereality, and Early Romantic Ideas About Music and the Nerves

Abstract: Between 1820 and 1850, the sounds of the newly invented harmonium, a wind-operated keyboard instrument, were regularly used in the clinical treatment of nervous disorders. The linking of the harmonium with nervous effects holds much in common with earlier associations of glass harmonicas with pathology, which has recently been investigated by James Kennaway. However, the medical implementation of the harmonium also differs from this tradition, not least in its later trajectory of use and largely positive reception as an "ethereal instrument." For example, a variety of harmoniums populate Honoré de Balzac's novels, where the sounds of the instrument are deployed to a variety of unusual mental states. I propose that studying the discourse around ethereal mediums can help illuminate the attitude that certain types of sounds were ethereal, and thus had privileged access to the nerves. Specifically, I claim that the unusual timbres and swelling dynamics of newly popular musical instruments, including the glass harmonica and the Aeolian harp, were elided with ideas about a vibratory nervous system and ethereal world spirit, both of which were essential to the formation of the culturally determined ideal of ethereality in the eighteenth century. Closely reading a number of medical case studies from the early nineteenth century, I propose that the idea that certain types of sounds were ethereal, and thus had unmediated access to the nervous system, influenced the design and reception of musical instruments in the nineteenth century, most notably in the case of the harmonium.

Author: Isaac Record

Title: Remaking the Past: 3D Methods in HPS and STS

Abstract: I consider the role of emerging technologies like 3D scanning and printing (3D) in HPS and allied fields. I explore the potential of 3D scans to transform access to artifacts and I evaluate the status of 3D printed artifacts as stand-ins for originals or as potential museum appropriations. I investigate the limits of digital fidelity and contemplate how we might reshape disciplinary boundaries to incorporate new research methods like 3D. I argue that 3D makes possible certain kinds of investigations that should now be considered necessary for making certain kinds of arguments within HPS/STS. The chief argument in favour of 3D is that it may provide new evidence for HPS/STS. The principled argument against 3D in HPS/STS amounts to boundary policing: Because HPS/STS doesn't train its practitioners to use or evaluate 3D evidence, it should not be used. I argue that HPS/STS has always benefitted from a strongly interdisciplinary set of methods, so rather than reject 3D, we should instead focus our concerns on recalibrating our evidentiary standards to handle 3D evidence. I consider precedents for adopting new technologies as appropriate for disciplinary research and propose a cost-benefit analysis for adopting 3D, weighing the capital, training, and infrastructure investments against the potential research dividends. I argue that even if 3D loses out at present, it promises lower costs and greater benefits in the future, which should shift the balance.

Author: Emily Redman

Title: Measuring Worth: Constructing Narrative of Value for Precollege Mathematics Education in the United States

Abstract: The K-12 mathematics classroom has historically stood as a symbol for contemporary domestic concerns, from civil rights and educational equity to economic, militaristic, and technological supremacy. Though narratives about the importance of math education—those emerging from politicians, educational reformers, school and college administrators, media figures, parents, and a seemingly endless variety of other interested constituencies—generally center on curricular

reform efforts, the underlying discourse has persistently encompassed broader political, intellectual, economic, and social concerns. Yet despite the often radical alteration of such concerns over time—as dictated by the parameters set by momentous events in the nation’s history—the value of the math classroom as an entryway for addressing these concerns was rarely in new or updated terms. While the historical backdrop changed, the narratives framing mathematics education did not; indeed, a sort of sinusoidal crisis/response pattern of reform and narrative can be readily mapped atop a changing political, economic, and social backdrop of American history. The continuity of symbolic relationships between the precollege mathematics classroom and broader domestic concerns offers a lens through which we can better understand the construction of narratives and rhetoric in explaining and valuing the role of math education in the United States from the Early Republic to the present. Furthermore, exploring why we see historical continuity in these narratives will help us better understand the underlying conceptual structures that frame our understanding of the history of mathematics more generally.

Author: Jonathan Regier

Title: Kepler on Contingency and Matter

Abstract: Kepler is considered by all of his commentators to have a particularly strong principle of sufficient reason. Everything that exists must not only have cause, the cause must go back to a governing geometrical idea. In his *De Stella Nova* (1606), Kepler criticizes Bruno for leading us into a labyrinth without center, middle, or boundary. In his *Epitome Astronomiae* (1618), he goes further. He suggests that in a universe of infinite worlds, all stars must be arranged uniformly. Koyré overstates this case. He writes: “Qu’il soit fini ou infini, le monde doit exprimer une structure géométrique. Mais alors que pour un monde fini il est raisonnable de choisir une structure particulière, le principe de raison suffisante empêche le Dieu de Kepler, un Dieu à esprit géométrique, d’agir de même pour un monde infini” (*Du monde clos à l’univers infini*). In the second edition of the *Mysterium cosmographicum* (1621), Kepler concludes that stars are devoid of order (*expers ordinis*), an assertion that he justifies by gesturing toward their matter (*materia*), for whom infinite diversity is appropriate. In my talk, I will discuss how Kepler, all while giving matter a supremely mathematical character, never questions its essential contingency. These considerations will lead me, on the one hand, to an examination of necessity and contingency in his mathematics and account of divine choice. On the other hand, I will also consider Kepler’s nearness to Stoic and Neoplatonic matter theories of the sixteenth century. Autrement dit, Kepler mathematizes matter, but he never sterilizes it.

Author: Marie Reinholdt

Title: Exploring Predispositions and Predictors: High-Risk Schizophrenia Research and Visions of Prevention at Psykologisk Institut, Copenhagen, 1960-1990

Abstract: During the 1960s, a notable shift occurred in schizophrenia research from retrospective studies of the manifestly psychotic to a much wider range of investigation encompassing the characteristics of relatives and asymptomatic 'high risk' subjects. This development was significantly shaped by a number of NIMH-sponsored studies conducted by Danish and American researchers in Copenhagen. Among these was a prospective longitudinal study of children of schizophrenic mothers, which inspired a large-scale research program in the US and foreshadowed the currently prominent early intervention movement. On the other hand, aiming to disentangle genetic and environmental influences, the Danish Adoption Studies compared the biological and social relatives of schizophrenic and control adoptees. While different in scope, these investigations continue to be widely hailed as ground-breaking in providing convincing empirical evidence for a major role of hereditary predisposition in the development of schizophrenia. At the same time, with their emphasis on the notion of 'borderline' or 'spectrum' states, they significantly influenced thinking about schizophrenia in a dimensional, developmental direction. The present paper will focus on the theoretical, organizational and ethical implications of the high risk research strategy, including the hopes it raised for future possibilities of prevention, in the light of recent developments and controversies relating to 'attenuated psychosis' and early intervention. In this connection, I shall examine the decision to carry out the studies in Denmark, a small homogeneous welfare state with a strong tradition of epidemiological research, extensive population and psychiatric registers, and relatively relaxed attitudes to the individual’s right to privacy.

Author: Susan Rensing

Title: “The Eugenics of the Present Has Too Little of the Feminine in It”: Gendered Debates about Eugenic Marriage in the Progressive Era U.S.

Abstract: Women’s reformers advocated for eugenic marriage laws during the Progressive Era, requiring a medical certification of health before issuing a marriage license. Professional eugenicists derided these laws, believing them to be not eugenic at all because the medical examinations necessary for certification only tested for venereal disease. Charles Davenport tried in vain to insist that “eugenics is to be distinguished from sex hygiene” and that women’s reformers should

be relegated to the sidelines in discussions of eugenic social reforms. Nevertheless, women's reformers across the country eagerly lobbied for eugenic marriage legislation and saw these laws as a central component to women's advancement. Eugenic marriage legislation has not received serious consideration by historians because of the mistaken assumption that these laws were only intended to prevent venereal disease and therefore eugenic in name only. This assessment reflects the bias of the professional eugenicists like Davenport who actively tried to disassociate eugenics from sex hygiene and women's reforms. This paper will explore the public debates about eugenic marriage reforms and analyze the gender policing of women's involvement in these reform efforts.

Author: Sarah Reynolds

Title: Observers on Other Worlds: Johannes Kepler and his Extraterrestrial Life

Abstract: Early telescopic observations of the Moon and planets prompted great interest in the possibility of life on the Moon and other worlds. In his published response to Galileo's *Sidereus Nuncius*, Johannes Kepler was quick to point out the likelihood of inhabitants existing "not only on the Moon, but on Jupiter as well." As an ardent Copernican, Kepler seems to have been particularly interested in inhabitants of the Moon and other planets because they could serve as immediate remote observers for his exercises in implementing Copernican astronomy. He develops this to its fullest extent in his *Somnium* (The Dream), in which he describes astronomy as it would be known on the Moon by the lunar-dwelling "Volvans." While the scientific content of Kepler's *Somnium* is often overlooked due to its allegorical framework and the apparently speculative nature of its discussion of space travel and lunar inhabitants, this work demonstrates Kepler's great interest in the relationship of beings with their environment and his awareness of the physical challenges that the lunar environment might pose. In this paper, I review the theological, philosophical, and scientific factors at play in Kepler's views on extraterrestrial life. I will discuss the literature Kepler draws upon and the tradition he is working within in his *Somnium*, particularly in the way he connects astronomy with geography and ethnography. Finally, I will consider what Kepler's references to extraterrestrial life in the *Somnium* and in his other works reveal of his views on the interaction between life and its environment.

Author: Jean-Olivier Richard

Title: Men in the Machine: Père Castel and the Art of Avoiding Catastrophes

Abstract: This paper examines the "natural disaster" theory of the French Jesuit natural philosopher Louis-Bertrand Castel (1688-1757). More specifically, it contextualizes this theory within his Aristotelian and Christian humanist conviction that human agency opens an artificial realm allowing the perpetuation of movement, mixtures, and life on earth. Castel believed that through "artifices" such as farming, industry, and land engineering, humans were unwittingly responsible for weather change. While he saw this as a primarily positive and necessary force, he also argued that irregularities of nature — storms, drought, earthquakes, volcanic eruptions — were caused by the physical and moral abuses of men. As a Catholic mechanical philosopher committed to naturalistic explanation (unlike some of his Protestant, Jansenist and Augustinian contemporaries), Castel argued that disasters were self-inflicted punishments, the mechanism for which God had instituted at Creation when He introduced spiritual beings imbued with free will (i.e. human souls) into the machine of nature. The Jesuit thus struck an Aristotelian middle course between attributing natural disasters directly to God's supernatural intervention and reducing them to purely mechanical or astro-meteorological events. In holding the view that humanity was both physical and spiritual in nature, he respected his commitment to secondary causes while avoiding materialistic or deterministic interpretations. Most importantly, his theory suggested that catastrophes could be avoided if human beings achieved a better knowledge of the impact of their action upon nature.

Author: Marsha L. Richmond

Title: Women as Public Intellectuals: Rachel Carson, Charlotte Auerbach, Genetics, and Post-World War II Scientific Activism

Abstract: With the dawn of the atomic age, a number of geneticists assumed the role of public intellectual. Drawing on their expertise, they adopted a persona calculated to reach a large audience in order to inform debates about nuclear fallout and radiation involving issues relating to heredity and reproduction. The scholarship discussing the post-war activism of geneticists, however, almost exclusively focuses on males. Little attention has been paid to how gender may have impacted the persona adopted to bolster women's authority and garner the public trust. This paper will examine two women trained in genetics who became activists after the Second World War to educate the public about dangers posed by radiation and the use of wartime chemicals. In *Genetics in the Atomic Age* (1956), Charlotte Auerbach (1899-1994) used basic genetics to teach about radiation's ability to cause mutations in the germ plasm that could threaten future generations. In *Silent Spring* (1962),

Rachel Carson (1907-1964) likewise drew on genetics to warn about the possible mutagenic properties of DDT that posed a threat to humans and animals alike. This paper suggests that both women approached their role as public intellectual differently than men, constructing a persona and mobilizing their authority to appeal to women as well as men with the aim of enlisting them in challenging male-dominated state policies and corporate interests.

Author: Lukas Rieppel

Title: Locating the Central Asiatic Expedition: Science, Business, and Foreign Intelligence

Abstract: From 1918 to 1927 the American Museum of Natural History sent a large team of scientists, assistants, and photographers to Mongolia's Gobi desert under the leadership of Roy Chapman Andrews. Its widely publicized goal was to uncover fossil evidence for a speculative theory promulgated by the Museum's president, Henry Fairfield Osborn, which located the evolutionary origins of modern humanity in Asia rather than Africa. Despite Andrews' best efforts, however, his team failed to find any evidence that Asia served as the "cradle of mankind." Still, the venture achieved both popular and scientific acclaim, primarily for the first recorded discovery of fossilized dinosaur eggs. In my presentation, I will locate the Central Asiatic Expedition at the intersection of a project to gather natural knowledge with that of securing political and economic intelligence. Andrews personally reported his findings to the US Office of Naval Intelligence (a precursor organization to the CIA) as well as the American Museum of Natural History. Not only that, but the expedition also served as a popular spectacle, and Andrews took steps to produce a feature length motion picture film in Mongolia. Finally, it also served as a paid advertisement for companies such as Asia Magazine and Dodge Motor Company, both of which helped sponsor the undertaking. Understanding the complex nature of Central Asiatic Expedition thus challenges us to integrate a diverse array of motives, functions, and practices into a complex assemblage that simultaneously sought to further the cause of science, business, entertainment, and foreign policy.

Author: Stephan Risi

Title: The Long Prehistory of Electronic Cigarettes: "Project Ariel" 1962-1966

Abstract: Electronic cigarettes are alternative smoking devices, which administer nicotine by heating a nicotine-bearing solution. Over the last few years, as market shares of these devices have soared, public health scholars have been working to understand the advantages and disadvantages of these new devices. E-cigarettes, they seem to agree, are something utterly novel and unprecedented. However, aerosol smoking devices akin to today's e-cigarettes actually have a far longer history, dating back to the 1960s. Drawing on hundreds of formerly secret documents, this paper documents the history of 'Project Ariel,' an effort by British American Tobacco (BAT) to develop what can be described as the first electronic cigarette between 1962 and 1966. Realizing that nicotine is the essence of tobacco, BAT sought to develop a device that would administer nicotine by heating instead of burning tobacco, thereby eliminating the tar from the smoke. After three years of development, BAT had succeeded in producing a number of prototypes and received two patents on aerosol smoking devices, but ultimately decided to abandon the project to avoid endangering its main product, cigarettes. Fifty years later, the documents chronicling Project Ariel remain important because they contain the first instantiations of many of the discussions that surround e-cigarettes today: Can addiction and harm be separated? Could aerosol smoking devices actually save lives? And if so, how would they need to be regulated? Looking at Ariel today both recovers an important part of the history of tobacco and can inform our present approach to e-cigarettes.

Author: John Robbins

Title: "It Lives!" Frankenstein and the Formation of Public Scientific Discourse

Abstract: The beginning of the nineteenth century in England saw radical advances in the life sciences. Public experiments by figures such as Luigi Galvani and Alessandro Volta seemed to confirm the ability of technology to cure disease, explain the mysteries of life, and even raise the dead. However, these displays also generated moral outrage at a perceived overreaching of natural boundaries, and served as catalysts for debates about the place of scientific discourses within the public sphere. This paper examines these debates through the lens of Mary Shelley's novel *Frankenstein*, focusing especially on its hugely popular stage adaptation, *Presumption*. The play was seen as a metaphor for the life sciences' fraught potentiality: *Presumption* quickly became far more popular than its parent text and, in a stark departure from its source, presents a mute Creature who is amoral and relentlessly destructive. The essay argues that *Presumption* therefore replicates the simultaneous public appeal and horror produced by emerging scientific advances. However, by depicting a symbiotic union in which these new technologies come to serve the public good, its ending offers a more palliative vision for

the place of science within society than the novel. Taken together, these texts therefore help mark out part of a larger trajectory in which institutions such as the novel and the theater influenced perspectives about the place of science in society. At the same time, they serve as a commentary on contemporary questions of the role of technology, ones no less urgent now than during the Industrial Revolution.

Author: Ann Robinson

Title: What Constitutes Discovery?: Chemists, Physicists, and the Synthesis of Heavy Elements

Abstract: Traditionally, the question of who discovered a new element rested on two things: publications and experiments. For heavy elements, however, the case is a bit more complex. These elements do not exist naturally; rather, they are created in particle accelerators, which cost millions of dollars to build and operate. They come in the form of several different isotopes, the stability of which varies. As the elements get heavier and heavier, their isotopes are less likely to exist for more than a few seconds, often for only fractions of a second. Another complication is the fact that these elements are made one atom at a time. Their short half-lives combined with the small number of atoms created makes chemical detection very, very difficult. Detection of new elements generally relies on the use of physical methods. A major point of contention between the discoverers of synthetic elements is which method is the most reliable and accurate. Another is the importance of chemical identification. From the 1950s through the 1990s, the discovery of new elements was very much an activity of Cold War big science. The Lawrence Berkeley Laboratory, in California, was at odds with the Joint Institute for Nuclear Research, at Dubna, near Moscow. This paper will examine controversies between the chemist led group at Berkeley and the physicist led group at Dubna over the criteria for determining the discovery of new elements.

Author: Hilary Robinson

Title: Beat Policing and Forensic DNA Databases in Twenty-First Century Crime Control

Abstract: This paper aims to illuminate the relationship between street-level policing and DNA databases in a criminal justice system in the United States that vastly over-represents racial minorities. Formal legal challenges have little impeded the growth of these databases and their use under existing "equal protection" doctrine due to the limitations of disparate impact analysis as a heuristic for establishing unlawful discrimination. Yet using large databases of biological information as a form of crime control relies on precisely the type of statistical analysis that the U.S. Supreme Court has rejected as proof of constitutionally-impermissible discrimination by law enforcement. The paper argues that this reasoning is held up by the erasure of the social concept of "race" in the process of translating samples gathered at the street-level into "non-raced" databases of genetic alleles cataloged and sorted using computer algorithms that rely on statistical probabilities, rather than raced faces, to represent identity.

Author: Lauren Ross

Title: Koch's Criteria of Disease Causation

Abstract: Robert Koch is perhaps best known for his criteria of disease causation, popularly referred to as "Koch's postulates." These criteria are considered by many to be the first method that could be used to establish that a contagion is the cause of a disease. Historians and philosophers have traditionally analyzed Koch's postulates in terms of causal necessity and causal sufficiency. On this approach, Koch's postulates are often interpreted as establishing that a contagion is the cause of a disease if the contagion is both necessary and sufficient for the disease of interest (Carter 2005; Broadbent 2009). In this presentation, I argue that analyzing Koch's work in terms of causal necessity and causal sufficiency fails to capture important and complex aspects of his method of establishing causality. I demonstrate this by examining the causal reasoning that Koch exhibits in his original work. Furthermore, I indicate how Koch's criteria of disease causation can be well understood with Woodward's interventionist account of causation (Woodward 2003). Interpreting Koch's criteria of disease causation with this interventionist account can help explain why he conducted specific experiments to establish causality, came to specific conclusions from the results of these experiments, and considered certain contemporary claims relevant or irrelevant to determining causality. Interpreting Koch's work from this interventionist perspective not only resolves a number of existing questions regarding the content of his publications, but also clarifies the complex and careful reasoning he employed in his revolutionary work on disease causation.

Author: Margaret Rossiter

Title: A Short History of the Yale Department of the History of Science and Medicine, 1960-77

Abstract: In January 1960 the Yale Corporation created a new Department of the History of Science and Medicine to replace an existing one of the history of medicine in the medical school. This grew out of the enthusiastic reception by a large local audience to a series of lectures on “Little Science, Big Science” by Derek Price the previous year. There were some cautions from the historians, but these were overridden by a cluster of scientists, including G. Evelyn Hutchinson, Joseph Fruton, S. Dillon Ripley, and others. Among the leaders of this group was John F. Fulton, a past president of the History of Science Society, and Sterling Professor of the History of Medicine, who had just received a multi-year training grant in the history of medicine from the NIH. This initial euphoria was broken, however, by Fulton’s sudden death later that spring. Within a year, however, enthusiasm revived as Ripley’s contacts in the foundation world yielded a million-dollar endowment for an Avalon Professor of the History of Science, which was awarded to Price. He proceeded to hire Asger Aaboe, a student of Otto Neugebauer, to join Leonard Wilson, who had been at Yale assisting Fulton in revising his text on the history of physiology, and Frederic L. Holmes. Conditions began to unravel, however, in the late 1960s, when the NIH grant was not renewed, and two potential junior faculty members were not hired. Then other appointees were not allowed to come up for tenure. Before long various committees were formed to evaluate the department, which the provost finally discontinued in the spring of 1977, ironically just a month before Prof. Martin Klein became one of the few historians of science ever elected to the National Academy of Sciences. Department records at the Yale University Archives give some hints as to what went wrong, what lessons can be learned, and what in hindsight might have made a difference.

Author: Daphne Rozenblatt

Title: Legalizing Psychiatric Expertise: Emotions as Scientific Fact and Legal Proof in Modern Italy

Abstract: Guilt: no other word attests more convincingly to the interrelationship between law, proof, and emotions. In a criminal court, it means one is held culpable of a specific offense, such as murder; at the same time, one’s feeling of guilt or expression of atonement can affect that same verdict. In an Italian courtroom of the nineteenth century, the work of the psychiatrist was to determine the defendant’s guilt, in its double sense of verdict and emotion. This paper investigates the advent of clinical psychiatry, the psychiatrist as expert witness, and emotions as a categorical imperative for arbitrating crimes of passion in nineteenth century Italy. It examines the changing work of the psychiatrist who adapted clinical practices to the needs of the court by constructing emotional evidence regarding criminal defendants. Two kinds of proof factored into a court decision over crimes of passion: proof that a crime had been committed, and proof of the motives for that crime. Those two proofs were substantiated by two kinds of evidence, one material and preferably bodily, the other non-material. But what constitutes proof and who crafts internal qualities into external evidence? How can one substantiate the emotional motives of a criminal? The role of the expert resulted from a gift exchange of validation: courts had scientific proof for their verdicts while the state sanctioned the psychiatrists’ nascent discipline. In adapting to the needs of the courtroom, psychiatrists extended and changed the nature of psychiatric work and their role as servants to the modern state.

Author: Helen Rozwadowski

Title: Science and Supranationalism

Abstract: Helen M. Rozwadowski is an associate professor of history and maritime studies at the University of Connecticut with interests in ocean history, history of science and environmental history. Her most explicit contribution to the history intergovernmental science institutions is *The Sea Knows No Boundaries: A Century of Marine Science Under ICES*. The International Council for the Exploration of the Seas (ICES) was founded in the throes of the turn-of-the 20th century internationalist movement, which included significant attention to scientific and technical issues. The oldest intergovernmental marine science organization, ICES survived into the post World War II period as one among a growing number of such organizations devoted to fisheries, marine sciences, whaling research, global geophysics— that is, to areas in which ICES had formerly provided leadership. To the roundtable Rozwadowski contributes historical context from one of the few intergovernmental institutions to cross the wartime divide. Rozwadowski has also studied the history of ocean sciences in the 19th and 20th centuries and, recently, the history of undersea exploration in the 1950s and 1960s. International cooperation characterized ocean sciences (and also sciences of the atmosphere, polar regions, etc.), so she invites consideration about whether characteristics of the ocean environment promoted cooperation or shaped international science. In conjunction with work by Carmel Finley and Kurk Dorsey, which covers areas of science and policy that departed ICES for new postwar institutions, Rozwadowski intends to discuss changes to scientists’ interventions in policymaking from a prewar activist stance to that of an “objective” advisory role.

Author: Matthew Sargent

Title: How Social Boundaries Limit Access to Indigenous Knowledge: Case Studies from Sixteenth-Century India

Abstract: This paper explores how Europeans' access to indigenous natural knowledge was shaped by the social systems that framed their interactions abroad. By attending to the ways in which social divisions in society – marked by boundaries of caste, language, and theoretical orientation – structured European encounters with foreign peoples we can better understand the discoveries and omissions in cross cultural information transfer. The first case follows Garcia da Orta, a doctor to the Portuguese viceroy, compiled and published his *Treatise on the Simples and Drugs of India* (1563), which gave Europe its first concrete source on Asian medical practice. Through close readings of his writings, I argue that da Orta was able to access only certain schools of Indian medical knowledge with which he shared a common theoretical framework and close social contacts. While he shared social ties and a common theoretical base with the Muslim-influenced physicians at court, he was never able to bridge the social, linguistic, and theoretical barriers with other medical traditions; for example he never mentions Sanskrit nor the vast corpus of Indian medical writings. The second author, Filippo Sassetti, was a Florentine merchant with close connections to the Medici court, who exchanged numerous letters with the political elites and intelligentsia of Italy. Sassetti was interested in foreign languages and texts and engaged with Sanskrit treatises rather than medical practitioners. Engaging with a different segment of local culture, his letters describe the vast wealth of Brahmin medical knowledge and compare it favorably with classical western authors.

Author: Jay Sarkar

Title: Transnational Networks of Nuclear Scientists and North-South Technological Cooperation during the Cold War: The Case of India, 1950-1974

Abstract: This paper, based on multi-archival research in France, India, the United Kingdom and the United States, studies the role played by the transnational networks of scientists in the negotiation of bilateral technological cooperation in reactor technology in India during the period, 1950-1974. At the center of this narrative is Homi J. Bhabha, chairman of the Indian atomic energy commission from 1948 until his death in January 1966. While Bhabha returned to India with the outbreak of World War II, he maintained close ties with many of his former colleagues from the Cavendish Laboratory in Cambridge, some of whom became heads of their national atomic energy authorities. Bhabha's proximity to John D. Cockcroft in the United Kingdom, W.B. Lewis in Canada, Francis Perrin and Bertrand Goldschmidt in France, had a significantly positive impact on the negotiations leading to nuclear cooperation agreements between India and these countries. In the years after Bhabha's death, Indian physicists like Vikram Sarabhai and Homi Sethna amongst others, tried to continue his legacy. With India's first nuclear test in May 1974, the situation radically altered. The superpowers strengthened the nuclear non-proliferation regime such that bilateral technological cooperation with India proved difficult to materialize. This paper argues that until May 1974, India's atomic energy program benefitted from the transnational networks of politically significant nuclear scientists. These networks facilitated a North-South flow of technology transfer that would have otherwise proved difficult in the backdrop of East-West rivalry of the Cold War.

Author: Amy Sayward

Title: Science and Supranationalism

Abstract: Amy Sayward is Professor of History at Middle Tennessee State University with interests in 20th-century international history, with an emphasis on the history of economic development. Her first book, *The Birth of Development: How the World Bank, Food and Agriculture Organization, and World Health Organization Changed the World, 1945-1965*, specifically looked at the role of United Nations specialized agencies in imagining and implementing economic development programs in the period after the Second World War. Her current book project, *The United Nations and International History*, examines the work of the U.N. and specifically points to areas for further research for the next generation of students and scholars in the field of international history. At the roundtable, Sayward will discuss the ways in which scientific authority has been augmented, disputed, and mediated by the different groups of stake-holders in the international arena. Using the case study of the World Health Organization's Malaria Eradication Program, she will identify the stake-holders—national governments; WHO staffers; malariologists, entomologists, and tropical medicine specialists; charitable organizations; social scientists; the Catholic Church; and local inhabitants—engaged in a lively conversation about the best path forward. As such, this case study complicates a narrative of scientific authority as there were different groups of scientists pursuing different goals in addition to actors outside of the scientific community who also exercised authority within the debate. Furthermore, we clearly see how the international environment, especially Cold War dynamics, was at least as important in launching the Malaria Eradication Program as scientific imperatives.

Author: Robin Scheffler

Title: “Small Scale Purifications Are No Longer Practical”: Scaling Up Retrovirus Research in the 1970s

Abstract: Early twentieth century cancer virology research was pursued by a handful of researchers working in isolation from one another. This changed in the late 1960s and early 1970s due to the intervention of the National Cancer Institute (NCI), which sought to expand cancer virus research along the lines of mission-oriented “big science” during the War on Cancer. Ironically, the expansion of RNA tumor virus, or “retroviruses,” studies resulted in the identification not of external human cancer viruses but of internal cancer genes, or “oncogenes.” This discovery has until now been discussed as a straightforward intellectual progression, with little attention to how cancer virus research was changed by the NCI’s intervention. This paper examines the progress and pitfalls associated with the NCI’s attempt to scale up retrovirus research through the analysis of the forms of experimental life found in the laboratory of J. Michael Bishop and Harold Varmus, which designed the first probe for cellular oncogenes in 1976. Neither Bishop nor Varmus had done any work with cancer viruses before 1970 but their proposal to study retroviruses attracted generous support from the NCI. This support allowed the laboratory to contemplate ambitious procedures to exploit the experimental possibilities of their chosen retrovirus—Rous Sarcoma Virus. In exploring these possibilities the laboratory’s structure was refashioned into a cooperative effort directed as much at the production of RSV as its study—a kind of biological research larger than the individual but of a smaller scale than the national project envisioned by the NCI.

Author: Patience Schell

Title: Natural History and Leading the Good Life in Nineteenth-Century Chile

Abstract: In his instructions to amateur naturalists on catching, preserving and shipping fish specimens, one of Chile’s naval officers waxed lyrical on the spiritual benefits that fishing in the name of natural history offered. It was emotional work, which required a vivid imagination and encouraged self-discipline. He was not alone in identifying the practice of natural history as good for the individual: other practitioners and supporters concurred. Some went further, arguing that the lives of Chile’s naturalists, detailed in biographies, unpublished manuscripts and obituaries, offered examples of salutary role models for young people to emulate, so they might learn how to be of service to their community and benefit the country at large. This paper will explore the reasons that, by the end of the nineteenth century, Chile’s natural history community argued that natural history was of value not just for the knowledge about Chile’s plants, animals and minerals that it produced, but also because of natural history’s improving role in the lives of individuals and in society. This Romantic-inspired justification for engaging in natural history was not unique to Chile, where the natural history community had a long history of embracing foreigners and yet became firmly rooted locally through strong government support. Analysis of how this discourse developed in that country, however, contributes to our understanding of the specific contexts of natural history practice, the ways in which natural history (and the sciences more broadly) become national concerns and the transnational circulation of ideas.

Author: Jutta Schickore

Title: “Control(led) Experiments” in Late Nineteenth-Century Biomedicine

Abstract: Arguably, the use of controls is a key strategy in scientific experimentation. But apart from some work specifically on the emergence and career of randomized controlled trials, there are few historical studies of experimental control. This paper offers an interpretation of experimenters’ views on control(led) experiments in mid- to late 19th century biomedical sciences. There are at least two strands in the discussion about controls, one concerning the comparison of populations, the other the comparison of individual experiments. For methodological thought in 19th-century biomedicine, the second tradition is the more relevant. Focusing on concepts of control in late 19th-century bacteriology, immunology, and experimental embryology, particularly in the works of William Welch, Paul Ehrlich, and Jacques Loeb, I show that in these contexts, the concept of control could mean three things: a practice that “controls for” the impact of specific factors on experimental outcomes, a practice that corrects for unknown variables, and the design of new forms of organic life. The first two practices were by no means novel – but only in the late 19th century, they were called “controls”. I argue that the introduction of the term “control” signals a loss of trust in the practical applicability of John Stuart Mill’s methodology of experimentation. Various experimenters maintained that Mill’s methodology expressed an unattainable ideal and that it could not address the most pressing problems of scientific experimentation in the life sciences – the complexity of living things. Control(led) experiments were seen as a realistic alternative to Mill’s ideal.

Author: Peter Schimkat

Title: Looking at Rocks like Abraham Gottlob Werner

Abstract: Abraham Gottlob Werner (1749-1817), teacher of Mineralogy and Mining at the Bergakademie Freiberg, was founder of a system of mineralogy which was based upon identifying specimens solely by visible external characteristics. Extremely influential in his own time period, heroized and vilified in equal measures since ... but what exactly was the purpose of his activities? My poster tries to shed light on this question. I argue that the historiographical problem concerning Wernerian mineralogy rests on a mistaken assumption about its conceptual core. Werner's all-encompassing system of mineralogy doesn't fit the notion of an (albeit within the constraints of a mining school) disinterested study of nature. Rather, it should be judged as an example of a cameralist study of nature devoted not to 'truth' - but to the pragmatic task of providing a heuristic set of rigid guidelines, which would enable his students to deal with absolutely everything to be encountered in the mineral world. Today, Werner is mostly remembered for his Neptunist views on rock formation. However, those theories played no role in the initial dissemination of his system of mineralogy. As far as Werner's contemporaries were concerned, his approach excelled because of its thoroughness and its virtually instant applicability. By trying to put Wernerian mineralogy into use – in words, pictures, and artifacts – I aim to illustrate that appeal. In addition, I would be very pleased to engage in discussions concerning the peculiar fate of Werner's system of mineralogy as viewed by later historians of science.

Author: Judy Johns Schloegel

Title: The Biological Philosophers: William Emerson Ritter and Herbert Spencer Jennings as Public Intellectuals

Abstract: The lives and careers of American biologists William Emerson Ritter (1856-1944) and Herbert Spencer Jennings (1868-1947) exhibit some remarkable parallels. Receiving their PhDs under E. L. Mark at Harvard's Museum of Comparative Zoology in 1893 and 1896, respectively, both biologists developed their philosophical credentials in the 1910s, engaged almost exclusively in popular writings and public speaking throughout the 1920s, before returning to some extent to field and laboratory work in the 1930s. This paper explores the historical circumstances in the years encompassing the Great War that facilitated Ritter's and Jennings' trajectories at those times. While Ritter's career at the University of California was significantly shaped by his close relationship with the wealthy newspaper publisher, E. L. Scripps, and his sister, Ellen Browning Scripps, Jennings' east-coast career was largely informed by more conventional academic contacts, including early philosophical study with John Dewey and considerable subsequent contact with pragmatists and pragmatism. Ritter and Jennings were relatively close colleagues: they championed one another as "biological philosophers" among their colleagues, encouraged each other's public stances, and critically engaged each other's philosophical and public writings. At the same time, however, their research topics, methods of study, and philosophies, while complementary, differed in significant ways. This paper examines both the parallels and differences in Ritter's and Jennings' careers as a means of exploring the cultural significance of the biologist as public thinker in the early decades of the twentieth century.

Author: Kathryn Schoefert

Title: "Human Beings Aren't Rabbits" (Grünthal, 1966): Scales at Play in Non-Therapeutic Pharmaceutical Trials c.1940 – 1970

Abstract: The pharmaceutical industry has been considered one of the largest-scale agents in the making of Big Biology and the bio-medical sciences. Yet, anthropologists of contemporary pharmaceutical sciences have also stressed the persistence of multiple scales, highlighting a "cottage industry" of early-stage pharmaceutical trials, where researchers, clinicians, and subjects negotiate translating findings between pharmacological mechanisms, industrial laboratories, clinical symptoms, and human bodies. My paper interrogates scales at play at a mid-twentieth-century cottage: the pre-clinical, non-therapeutic tolerance tests, known to the pharmacology department at the Swiss firm JR Geigy colloquially as the 'Grünthal trial', named after Ernst Grünthal (1894-1972). Largely situated at a Swiss psychiatric hospital, the brass instruments and student volunteers enrolled in the 'Grünthal trial' would have been familiar to mid-nineteenth-century physiologists and psychologists. Nonetheless, these practices were deployed idiosyncratically over three decades (1941 – 1971), in thousands of trials and hundreds of substances evaluated. Though the site could be summarised as exemplifying a transition between regimes of the "friendly expert" and standardised, company-regulated markers of pharmaceutical effects, I argue that at a meso-scale the 'Grünthal trials' capture the productiveness of a bottleneck between the large-scale enterprises of the pharmaceutical industry and the psychiatric clinic, exploited by both sides to surprising results for the biological and biomedical sciences. By 1968 the collaborations in the 'Grünthal trials' had contributed not only the very successful introduction of imipramine, typically labelled the first anti-depressant, but also yielded ethological and neuroanatomical insights into cetaceans and other mammals.

Author: Heinz Schott

Title: Mesmerism, Sexuality, and Medicine: “Karezza” and the Sexual Reform Movement

Abstract: Within the scope of certain social and religious movements mesmerism had a considerable impact on the American way of life during the last decades of 19th century. A famous example is the Christian Science of Mary Baker Eddy. But also less known groups adopted mesmeric ideas and practices. The paper focuses on the concept of ‘Karezza’. It combined a specific sexual practice with religious ideas of divine love, birth control, social reform, women’s emancipation, and health education. It was created by Alice Bunker Stockham (1833-1912), an obstetrician and gynecologist from Chicago. Among other authorities, the writer Leo Tolstoy and medical psychologist Havelock Ellis appreciated her approach. She was a pioneer of the sexual and marriage reform promoting practical advice for everyday life. As a doctor she stressed especially the disastrous consequences of a brutal sexual life destroying body and mind (not only of the women). As an antidote she propagated the ‘Karezza love’ avoiding ejaculation and a punctual orgasm (climax) during intercourse. The leading idea was the imagery of a mesmeric ‘fluidum’ uniting individuals spiritually. Bunker’s publications were translated into German. They corresponded to the Lebensreform movement, but never became popular. Also the early sexology about 1900 ignored Bunker’s concept as well as the sexual medicine later on. It is worthwhile to reconsider it within the context of the history of medicine, culture, and anthropology.

Author: Laura Senier

Title: Integrating Genomics into State Public Health Programs

Abstract: In May 2013, Oscar-winning actress Angelina Jolie announced that she had undergone prophylactic mastectomy after genetic tests had revealed that she was at very high risk for breast and ovarian cancer. This announcement magnified expectations that genetic testing would alleviate the public health burden of adult-onset diseases. It also, however, fueled concerns that genomic advancements might not be equitably available to all women, and raised questions about whether the US healthcare system is prepared to screen large numbers of women, to identify those who might benefit from genetic testing. State health agencies play a critical role in the translation of novel therapies into population-level screening programs and interventions, but have been largely ignored by scholars who study political barriers in research translation. This paper examines the success of public health genomics programs in Michigan. We trace this success through three eras: one dominated by educational programming around family health history; a second that concentrated on promoting a few evidence-based interventions; and a third that focused on policy development and program evaluation in testing for breast cancer genes. We show how Michigan’s adoption of the Core Public Health Functions model gave them the interpretive flexibility to respond to triggers and opportunities in their external organizational field. We also examine how they mobilized internal organizational resources and exploited public-private partnerships to augment modest resources. The ability to respond nimbly to opportunities has been a boon, but has come at a cost, as attention to disparities in access has faded over time.

Author: Minwoo Seo

Title: Know-how and Know-that as a Tool Kit

Abstract: Chemistry has been through its history involved with both lofty philosophical interest such as scientific realism and mundane historical concern such as its status between science and technology. This paper aims to offer a promising analytical tool to deal with both of these issues: know-how and know-that. It is now taken for granted among historians and sociologists that science and technology do not neatly map onto knowledge and its application, or the natural and the artificial, respectively. Yet, this is still out of the purview of philosophers of science, and given the fact that chemistry has been a pattern science that has blurred those boundaries, it may not be a surprise that philosophers of science have paid little attention to chemistry. Here, to adopt the pairing of ‘know-how’ and ‘know-that’ into our analysis, I suggest, is one way to address this issue. For to explore the relationship between the two and its historical alterations is a way to analyse different epistemic and social regimes in which chemistry is practised. To include know-how in the philosophical discussion can also advance our understanding of scientific realism debates, and help reframe the debates. Traditionally, scientific realism debates have only been waged on the level of scientific knowledge as know-that and its justifiability. But know-that, I argue, is inseparably embedded in know-how, and chemistry is full of cases to make explicit that relationship. The position taken is briefly described drawing on Wittgenstein’s On Certainty.

Author: David Sepkoski

Title: Extinction and the Value of Diversity

Abstract: As a number of authors have observed, biodiversity has come to be seen as an intrinsic scientific and cultural value. In other words, the sheer multiplicity and heterogeneity of living things is now understood to have an inherent value that is not reducible to the “worth” of any particular individual species: the value of diversity is diversity itself. Extinction plays a central role in this understanding of biodiversity, since diversity is something that is perceived to be fragile and tenuous, constantly endangered by the threat of loss. This paper will examine the influence of biological theories about the nature and dynamics of extinction—and especially mass extinction—on the current valuation of biological diversity. I will focus particularly on the ways that paleobiological analyses of global historical diversity patterns during the 1970s and 80s contributed to a new understanding of extinction as an often catastrophic phenomenon with significant and permanent ecological and evolutionary consequences. I will argue that this new model of extinction has played a prominent conceptual and rhetorical role in debates surrounding the current biodiversity crisis—it helps explain why modern Western culture values diversity and fears its loss.

Author: Ryan Shapiro

Title: “What the boys in the laboratory have been up to”: Space Dogs, Cold War Vivisection, and the “Muttnick Affair”

Abstract: “Communist Dog in Space,” hollered headlines. One month after the shock of Sputnik, Americans awoke to learn the Soviet Union had successfully launched a second satellite into orbit. Worse, within its steel belly, this artificial moon carried a breathing agent of the Kremlin. Only recently a stray on the streets of Moscow, the agent in the sky was a small mongrel dog dubbed “Laika.” And Laika terrified Americans below. Fear, however, was not the only emotion Americans voiced in response to Sputnik II. Concern for the experimental passenger locked inside her “rocket-shaped doghouse” flooded forth from across the United States. As the fact of Laika’s demise became apparent, this concern shifted to mass grief and outrage. Such sentiment became political capital. Soviet leaders assailed what they perceived as American hypocrisy in condemning the death of a single dog while neglecting segregation at home and imperialism abroad. Yet the Soviets were not the only ones to sense possibility in the outcry over Laika. American antivivisectionists embraced the opportunity to further their faltering crusade against animal experimentation. Until recently marginalized as fifth-columnists potentially aligned with Moscow itself, American antivivisectionists embraced the “ghost of that Russian dog” to both shed the stain of subversion and equate U.S. research practices with “Communist barbarism.” Employing archival, press, and Freedom of Information Act-obtained sources, this paper explores the implications of the “Muttnick affair” for the Cold War battle over animal experimentation, and the interactive relationship between popular culture and the national security state.

Author: Brittany Shields

Title: Cultivating Mathematics: Emigré Mathematicians and New York University’s Graduate Department of Mathematics

Abstract: The German emigré mathematician Richard Courant (1888-1972) joined the faculty of New York University (NYU) in 1934 with the task of building up graduate-level mathematics training and research there. Courant and his colleagues, including Donald A. Flanders, Robert G. Putnam, James J. Stoker (as of 1937) and the German emigré Kurt O. Friedrichs (as of 1937), worked to develop the graduate mathematics curriculum, expand the department’s research program, and cultivate a thriving community of mathematicians, all in the context of a depression-era economy, a strained academic job market, and currents of anti-Semitism. This talk will consider the social, cultural and economic environment in which these mathematicians worked in the 1930s as well as the specific processes of institutional development in mathematics at NYU from Courant’s arrival until World War II. It will also describe Courant’s experiences as an emigré mathematician navigating the American terrain in the 1930s to cultivate a premier graduate department of mathematics.

Author: Matthew Shindell

Title: Institutional Settings, Institutional Actors: Expertise, Policy, and the US National Academy of Sciences

Abstract: The US National Academy of Sciences, through its National Research Council (NRC), produces between two and three hundred reports annually, making it the primary institution of scientific and technical expert assessment in the United States. This paper reports on the initial findings of a study of the NRC’s expert assessment process, work that has combined historical archival research and participant observation. By addressing the very specific questions of how assessments are

done at the NRC and how the process is affected by the institution, its culture, and its history, this paper interrogates the ways in which ideas about the relationship between science and policy are understood to be embodied within this process and the organization of the institution itself. Beyond the institution's understanding of itself, this paper also presents a model of how historians can understand institutions like the NRC, both as settings for assessment and as meso-level actors in interactions between science and policy. This paper argues that a focus on the institution breaks down notions of directionality in the relationship between scientific expertise, assessment, and policy making, even while group identities and boundaries between groups may be preserved in the assessment process.

Author: Stephanie Shirilan

Title: Imperial Conquest and 17th c. Medical Contest in Abraham Cowley's *Plantarum*

Abstract: In the preface to his translation of Cowley's Neo-Latin botanical poem, Nahum Tate remarked Cowley's ability to "animate his silent Tribe of Plants" and "inspire them with Motion and discourse." My paper examines the power of this device in book V of the *Plantarum*, where the plants of Europe face off against recently discovered American specimens. Cowley makes the superiority of the latter quite clear, but just as the battle turns violent, Apollo pacifies the Native (plants) with song and the promise of European arts. My paper situates this imperial contest in the context of the embattled circulation of Native American botanical specimens among University-educated physicians, like Cowley, who studied these plants in their physic gardens and the "base empirics," like Nicholas Culpepper, who threatened to popularize these Apollonian pharmaceutical arts for the masses.

Author: Allen Shotwell

Title: Re-Appropriating Visual Knowledge: Image Reuse in Printed Works on Medicine in the Fifteenth and Sixteenth Centuries

Abstract: Almost from their very inception in the late fifteenth century, the images in illustrated books on medical topics were repeatedly and continuously re-used. Illustrations first used for a book devoted to one subject, say an herbal, reappeared in a book on another subject, like surgery, often written by a different author and printed by a different printer. Historians have tended to view the re-use of images in this way primarily in economic terms, as indications of the need for cost-saving measures in the cut-throat business world of early modern printing, but in this paper I suggest that tracing the origin and subsequent re-use of images in a number of texts over a long period of time also provides insight into the how medical topics were understood by authors, printers and readers. The wide variety of topics addressed by books containing the same image reinforces the close connections between botany, surgery and medicine while the re-use of an image with slight modifications in different books often indicated the growing importance of certain ideas. To explore how re-used images reveal these trends, I will trace some images originally found in a late fifteenth century herbal through their appearance in a number of surgical, anatomical and medical works up to the middle of the sixteenth century. Then I will follow a similar path for some anatomical images which originated early in the sixteenth century.

Author: James Skee

Title: The Century 21 Exposition: Building Confidence in a Space Age Fair in Seattle 1955-1962

Abstract: The Century 21 Exposition, also known as the 1962 Seattle World's Fair, is remembered today both for showcasing the promise of the Space Age and for the distinctive buildings and transportation system it left behind in the urban landscape. The story of how the Exposition came to be illuminates how science shaped ideas about trust and confidence in Cold War American capitalism. Seattle boosters had to convince politicians across the Pacific Northwest that a Seattle fair would be good for their constituents, and persuade investors and captains of industry to back the Exposition financially. Seattle boosters also wanted to use the fair to justify creating the Seattle Center, an urban renewal project intended to clear up what they saw as a blighted area north of downtown. The Exposition's boosters rallied diverse interests by hiring economic consultants, who used the new management science of the Space Age to build faith in the fair among disbelievers. Trained in operations research (OR), systems analysis, and other new forms of management science whose roots lie in the Allied military's operational research groups during World War II, men such as Bill Royce of Stanford Research Institute and Harrison "Buzz" Price of Economics Research Associates shaped how confidence and trust were thought about, using the "thin description" of rationality to create trust. Seattle's iconic Space Needle and Alweg Monorail are enduring material manifestations of how science built confidence, Space Age style.

Author: Naomi Slipp

Title: Cutting and Casting: Thomas Eakins & Anatomical Study in Gilded Age Philadelphia

Abstract: During the Gilded Age, the Pennsylvania Academy of the Fine Arts greatly expanded its artistic anatomy program under the direction of Thomas Eakins and William Williams Keen, Artistic Anatomy Professor from 1876-1889. In collaboration with Keen, Eakins led dissections for students in the Academy basement. In 1877, he began casting the anatomized cadavers to create plaster sculptures. These three-dimensional plaster casts of the body parts of dissected cadavers were utilized by students at the Academy, in Eakins's studio practice, and were gifted as sets to the University of Pennsylvania and the Academy of Natural Sciences. As anatomical casts, they are unique tactile remnants of the dissected body and present the cadaver as a permanent pedagogical tool that never decays. An analysis of their formal qualities as sculpture, both in painted plaster and bronze, allows for a consideration of their pedagogical function and isolates a fundamental difficulty faced by artists when representing the human body as anatomical: how to illustrate the exterior and interior as visible and complex. This paper argues that Eakins's anatomical casts highlight a search for scientific knowledge in Gilded Age Philadelphian artistic practice that extended beyond the idealized classical cast or the medical illustration to engage with and represent the human body as a tactile and three-dimensional medical model; one which revealed its internal structures and exterior form in a single visually compelling and legible object.

Author: Phillip Sloan

Title: The Three-Man Paper, the Bohr-Debates, and Schrödinger's *What is Life?*

Abstract: As is well-known, Erwin Schrödinger drew explicitly upon the "Three-Man Paper" for his 1943 popular Dublin lectures. In *What is Life?*, Schrödinger argues that biology can be reduced to physical determinism, with the new quantum mechanics playing a fundamental role in support of a concept of the gene as the master-molecule of life. This conclusion he specifically bases on Max Delbrück's analysis of the gene in the "Three-Man Paper."

In this paper, Sloan will elucidate the early background of Schrödinger's arguments through the exploration of his little-known participation in debates in 1932-33 with Pascual Jordan that also involved a critique of positions developed by Niels Bohr. This led Schrödinger to formulate a response that drew heavily on contemporary genetics literature, including especially Herman Muller's 1929 paper "The Gene as the Basis of Life." Prior to engagement with Delbrück, he had already developed against Jordan and Bohr the claim that quantum mechanics could solve the problem of gene stability and also warrant a strong reductionist view of life based on the permanence of the gene as the basis of life. Max Delbrück's subsequent exposure to this controversy in 1934 will be seen as a primary cause that drew him away from what may have been original interests in photosynthesis into consideration of issues of genetics. Out of this came the direct collaboration with Timofeëff and Zimmer in 1934-35. Delbrück's resultant development of the gene concept in the Three-Man paper displays the difference between his view of genes as related to developmental systems and cellular contexts, from Schrödinger's the gene-centric view in the *What is Life?* lectures which involved a fundamental misinterpretation of Delbrück's arguments.

Author: Jason Smith

Title: The Common Highway: Matthew Fontaine Maury, Naval Science, and the American Maritime World

Abstract: The paper examines the role of Lieutenant Matthew Fontaine Maury and the United States Naval Observatory, arguing that the work of the office and Maury's vision of an empirical, knowable, and representable marine environment promoted the idea that the sea was a common highway. This work proceeded from the competing idea that the sea had long been a kind of wilderness to the American mariner. By providing the navigator with Wind and Current Charts and Sailing Directions, Maury created pathways across the sea that framed an American commercial maritime empire while drawing on mariners themselves as his empiricists on the water. The paper reconsiders Maury's place in the American antebellum scientific world, highlighting his central role in bridging the communities of science, military, and maritime commerce to forge an effective, yet tenuous bond among these three often disparate and mutually exclusive communities. While Maury has fairly and unfairly been criticized for his scientific conclusions, the paper highlights his important and influential place among converging and diverging worlds at a crucial moment in the growth of American science.

Author: Joshua Smith

Title: A Living Journal: Current Anthropology as Action Anthropology

Abstract: In 1959, the inaugural 'pre-issue' of the journal Current Anthropology (CA) appeared and marked both an unprecedented growth and a profound shift in international anthropology. Edited and conceptualized by University of Chicago Anthropologist, Sol Tax (1907-1995), with the support of the Wenner-Gren Foundation, Current Anthropology's origins are firmly rooted in Tax's personal political engagements immediately following World War II. In the first issue of CA, Tax emphasized how Current Anthropology was uniquely shaped by the diverse collective of anthropologists all over the world and represented all sub-disciplines. In order to accomplish this goal, Tax expended impressive amounts of time and energy corresponding with several hundreds of colleagues and exhaustively travelled the world to figure out the global status of anthropology and incorporate everyone's perspectives into the scope and style of the journal. This unique vision for CA stemmed directly from Tax's theory and method of action anthropology, itself a product of Tax's anti-colonial work with Indigenous Peoples. This paper shows how Tax's interest in post-war decolonization movements and his work to organize the discipline shaped the direction of Current Anthropology. It is argued that Current Anthropology and Action anthropology are inextricably linked through Tax's practice of a personal anthropology.

Author: Julie A. Smith

Title: Representing Animal Minds in Early Animal Autobiography: Charlotte Tucker's *The Rambles of a Rat* (1857) and Nineteenth-Century Natural History

Abstract: Animal autobiography—a first-person fictional narrative in which an animal tells its own story—emerged in the late eighteenth century as the first attempt to represent animal minds in extended narrative form. Authors of this genre were anxious to create accurate, believable representations of their animal characters, even as they afforded them human language. One path to veridical representation was to write in sync with scientific understandings of animals as set out in books of natural history. A few authors are explicit about their debt to natural history, and their comments point to a broader dependency, an intentional compatibility, between the ideas of animals in animal autobiography and those in the popularized scientific discourse of the day.

Author: Curtis Sommerlatte

Title: Kant's Denial that Animals Have Consciousness

Abstract: In this paper, I consider Kant's views concerning the mental representational capacities of animals. There is abundant evidence that Kant denies that animals have consciousness, but he nevertheless considers them as having representations. My aim in this paper is to understand better this view by providing an account of Kant's notion of 'consciousness' in Kant. I argue that by 'consciousness' [Bewusstsein], Kant does not have in mind what might be called 'phenomenal consciousness', i.e. the 'what it's like' that can accompany representations. I argue that he instead views consciousness as a type of epistemic success and that this is why he denies that animals have consciousness. To get an understanding of the way in which consciousness counts as an epistemic success, I consider Kant's Germanic-philosophical predecessors. For their understanding of consciousness was tied up with their conceptions of the epistemic notions of clarity and distinctness. And I argue that while Kant can be better understood by looking to his predecessors, he nevertheless makes a significant break with them in his understanding of these same issues. The upshot of this is that understanding the nature of this break sheds light on Kant's view of the representational capacities of animals and on what he accordingly finds distinctive about human beings' representational capacities. Furthermore, in the course of this argument, we shall also learn more about the 18th-century Germanic conceptions of consciousness.

Author: Gabriela Soto Laveaga

Title: Knowledge of the "Non-Expert": Chemistry, Botany, and Peasants in 1960s Mexico

Abstract: In the mid-1950s Mexico led the world in synthetic steroid hormone production. Crucial to the industry were thousands of peasants who collected the raw material, wild yams, which served as the precursor to the production of steroid hormones. As the world learned more about the medical importance of steroids some peasants began to use the scientific method to locate, classify and experiment with wild yams, in some instances successfully altering the chemical purity of key ingredients. Using the case study of yam collectors in Mexico this paper encourages us to expand our understanding of the non-expert or the 'go-between' and ask critical questions about scientific knowledge production among the so-called intermediaries of knowledge.

Author: Andrew Sparling

Title: Paracelsus Was a Transmutational Alchemist

Abstract: Contrary to the received view, Paracelsus was a transmutational alchemist. He denigrated the vulgar notion that alchemy was about goldmaking for its own sake, but so did every good alchemist. Alchemy was not a petty enterprise; it was a high calling. For some time, Paracelsus did resist the possibility that one metal could be transmuted into another. His objection was theological. God, he thought, had created fixed species—for minerals as well as for birds, fishes, and beasts. He subsequently discarded that opinion, on empirical grounds. He described the apparent conversion of iron into copper in the vitriolic waters of a creek at a mine-site. Transmutations, he now believed, did occur in nature. Whatever nature permitted must also be possible by art. How, then, might artificial transmutations be effected? Paracelsus considered and rejected the possibility that a metal might be reduced to its three constituent principles (salt, sulfur, and mercury) and subsequently reconstituted as a different metal. He decided instead that transmutations must require adding a rarefied, vitalizing ingredient—a “philosophical mercury” or “primum ens.” In elliptical language, Paracelsus explained how to perform metallic transmutations. He veiled his words, so that only attentive readers with a grasp of metallurgical techniques would understand. Historians have regarded late-sixteenth and seventeenth-century Paracelsian alchemists as having failed to grasp that their master repudiated transmutation. That view is mistaken. The Paracelsians caught their master’s gist. They worked to realize their goal, using his tantalizingly incomplete instructions as a guide.

Author: India Spartz

Title: Curating Mars: An Exhibition Case Study Featuring Ray Bradbury, Sci-Fi and the History of Science

Abstract: Curating Mars: an exhibition case study featuring Ray Bradbury, Sci-Fi and the history of science. How is the history of 20th century space exploration shaped by science fiction? In what ways can the academic research library showcase their history of science collections through cross- disciplinary exhibits that feature scientific literature and sci-fi? The University of Arizona’s (UA) reputation as a world-class astronomy, planetary and space sciences research institution sparked the UA Special Libraries to collaborate with the UA Lunar and Planetary Laboratory, and guest curator and author, Dr. Gloria McMillan to launch the exhibit: “Mars Madness: Sci-Fi, Popular Culture and Ray Bradbury’s Literary Journey to Outer Space.” The exhibit showcases writer Ray Bradbury’s literary journey from his boyhood in Tucson, Arizona to a successful career in Hollywood. Dr. McMillan’s newly released book: *Orbiting Ray Bradbury’s Mars: Biographical, Anthropological, Literary, Scientific and Other Perspectives* serves as a central theme of Bradbury’s literary influence on the history of science. As a student of astronomy, Bradbury’s view of Mars was influenced by early scientific literature by Schiaparelli, Lowell and A.E. Douglas, whose works are also featured in the exhibit. In turn, Bradbury’s own literary impact on an emerging sci-fi genre shaped the public’s imagination of Mars and the space age. This paper is a case study about utilizing creative and cross disciplinary approaches to understanding the ways in which sci-fi, popular culture influenced the history of sciences in the 20th century.

Author: Richard Spiegel

Title: Sound and Vision: Visuality and the Role of Acoustics in the Birth of Modern Ophthalmology in Seventeenth-Century Europe

Abstract: This project sketches out the relationship between theories of optical nervous transmission and theories of acoustical phenomena in the seventeenth century. The rise of Cartesian physiology, based on the principles of matter and motion, during seventeenth century created the demand for a new theoretical vocabulary and a new set of analytical devices to explain nervous transmission. Theorists turned to the language of vibration, the visual analogy of wave propagation, and the phenomenon of sympathetic resonance to explain how the physics of the external world was translated into the physiological functions that enabled perception. I argue that our understanding of visuality in the period must account for both dioptrical theories of the eye, for which the relevant analogy was the camera obscura, and physiological theories of nervous transmission, for which the relevant analogies were principally acoustical. Neither one could be used to explain the other, but understanding both was necessary for understanding visual perception.

Author: Alistair Sponsel

Title: Coral Reefs as Objects of Scientific Study, from Threatening to Threatened

Abstract: “No human power can arrest the growth of [coral] reefs.” So lamented the British geologist Roderick Murchison in 1851. From the late-eighteenth century discovery that coral reefs were formed by organic growth until the mid-nineteenth century, the scientific study of reefs was justified primarily by the desire to overcome the threat these posed to the expansion of exploration and commerce. How did a natural phenomenon once viewed as a menace to human activity come to be seen as fragile, threatened directly by a variety of human activities and indirectly by imperialism and the growth of industrial capitalism? This paper traces changing attitudes to the formation and death of coral reefs. I explain why coral reefs once seemed particularly threatening among marine hazards and how changed scientific ideas mitigated the apparent severity of that threat by the late-nineteenth century. It was only in the second half of the twentieth century, however, that reefs came to be understood as threatened, and indeed as inherently fragile. I argue that this transition depended upon two technologically and culturally mediated shifts. The first was a shift toward contemplating anthropogenic threats not only to objects and organisms but also to natural processes, such as the growth of coral reefs. The second was toward identifying coral reefs with the “living” portion of the submarine structure that is a reef, which disaggregated that which was threatened (the “growth” of the reef) from that which remains an obstacle to navigation (the robust structure of the reef on the seafloor).

Author: Kaitlin Stack Whitney

Title: Virtual Water: Natural Resources in the Wake of Neoliberalism

Abstract: Freshwater is vital to life, a finite but renewable resource, which necessitates sustainable management and sharing. Environmental historians have written extensively about past water conflicts in places such as the American West, and more recently STS scholars have examined water rights and resources on a more global scale (e.g. the August 2012 special issue of *Social Studies of Science*, “Water Worlds”). At the same time, historians of science and technology have written on the epistemological and political consequences of modeling natural systems, most often in the context of climate change. Surprisingly little has been written, however, on the history of water resource modeling – both conceptual and mathematical – as a form of expertise and applied science. “Virtual water” is one such expertise. Coined by John Anthony Allan in the early 1990’s, virtual water refers to all of the freshwater consumed or transformed to produce commodities or services at their point of origin. In this paper, we trace the evolution of the “virtual water” concept, examining the arguments of Allan’s supporters and detractors across multiple disciplines. Doing so brings histories of water management into the more recent, “neoliberal” past, showing the ways in which water has become conceptualized as a fungible commodity. This work also broadens histories of environmental modeling, blurring distinctions between hydrological, ecological, and economic expertise. In addition, we demonstrate the influence that Allan’s 2008 Stockholm Water Prize has had on the uptake of “virtual water,” and examine the relationships between awards and other metrics of scientific success.

Author: Thomas Stapleford

Title: The Historiography of Practice

Abstract: This paper will set the stage for the session by laying out the historiography of practice, exploring how the use of practice as an analytic concept has shifted over time and tracing its diverse origins in a range of sources: sociology of knowledge, anthropology, the later work of Wittgenstein, and Foucault. At the heart of my account is an expansion in the scope of practice. Whereas writing about practice once meant looking strictly at changes in experimental work, methodology, or techniques that had direct epistemic import, today the focus has broadened to include practices whose significance lies in the cultivation of particular habits or ways of being. Likewise, even laboratory techniques can be seen as serving a dual role: creating specific knowledge and shaping practitioners themselves. In short, practice is important not only for its direct role in knowledge production, but for its role in shaping the producers of knowledge as individuals and communities. Having sketched this historiography, I reflect on the tensions and ambiguities that remain within it, owing to the diverse intellectual traditions that contributed to its emergence. Finally, I consider what new kinds of questions might be asked from this perspective, some of which are addressed in the session’s contributions. For example, how are we to understand the role of ethical norms and ideas about human behavior as both shaped by and shaping practices? How can we theorize the relationship between social communities, institutions, and practices? How can we account for change and failure in practices?

Author: Jacob Stegenga

Title: Medical Nihilism: A Brief History

Abstract: Medical nihilism—the thesis that we should have low confidence in the effectiveness of medical interventions—was expressed by the ancients (Heraclitus, Virgil, and Hippocrates), early moderns (Shakespeare, Dryden, Montaigne, and Molière), and by prominent physicians in the nineteenth century. An infamous quip in 1860 by Oliver Wendell Holmes,

Senior—the Dean of Harvard’s medical school—sums up such sentiments: “if the whole materia medica could be sunk to the bottom of the sea, it would be all the better for mankind and all the worse for the fishes.” In these expressions of medical nihilism I find three arguments: (i) that treatment is futile because diseases can be only ‘self-limited’, (ii) that medical interventions are ineffective, and (iii) that medicine is corrupted by financial incentives. My paper gives a brief account of the history of medical nihilism. With the discovery of insulin, antibiotics, and other effective medicines, and more rigorous methods of testing medical interventions (such as the randomized controlled trial), medical nihilism fell out of favor by the middle of the twentieth century. This is not a story of unbridled progress, however. In the last decade, many physicians, epidemiologists, and journalists have offered a variety of arguments which support medical nihilism—I call this the ‘new wave’ of medical nihilism.

Author: Beckett Sterner

Title: Mathematization and the Development of Methodology in Systematic Biology, 1960-1990

Abstract: The history of systematics in the late 20th century is commonly framed as a battle between two ideologies, phenetics and cladistics, with cladistics emerging as the eventual victor (Hull 1988). The two camps fought, often aggressively, to defend alternative philosophies about how to classify organisms and infer evolutionary lineages. However, this framing of the history obscures a deeper and more permanent change, one that was initiated by pheneticists and co-opted by cladists: the mathematization of methodology. Even as cladists and pheneticists differed, then, over which calculations to make or how to interpret them, they shared a common program of increasing the objectivity and explicitness of the field’s methods through mathematics. We examine what was shared and contested between these two groups in light of this alternative perspective by analyzing the tandem development of their methodologies with their respective mathematical procedures. Methodology as we understand it stipulates how certain problems should be solved in practice; it also concerns how to test and evaluate the quality of a scientist’s work in this regard. We argue that mathematization transformed methodology in systematics by standardizing the biologists’ understanding of and language for what they do in the course of their research. One crucial consequence is a close mapping between methodological problems in each camp and the mathematical structure of the procedures they followed. Moreover, early positive interactions between cladists and pheneticists led to both camps sharing certain basic mathematical structures across their methods, leading to comparable methodological problems even as their philosophical stances polarized.

Author: Cameron Strang

Title: Instructions in Independence: Amerindian Languages and National Science in the Early United States

Abstract: In 1826, officials in the United States’ Department of War produced a set of instructions intended to collect information on Indian languages. Although the Department of War funded this project, the impetus came from a small group of philologists keen on developing the “comparative science of languages” in the United States. Scholars suggest that the main goal of the natural philosophers and officials who wrote instructions for informants in the field was to discipline the production and movement of knowledge and, thus, generate standardized information. However, the Department of War’s instructions encouraged informants to collect and package information in whatever way was best suited to their local situation and personal talents. Historians have stressed that early American men of science struggled both to prove their worth to Europeans and to assert their intellectual authority over less learned Americans. Yet the philologists involved with creating the 1826 Vocabulary—particularly Peter DuPonceau and Albert Gallatin—rejected what they considered the European mode of gathering information through rigid instructions and the very notion that learned individuals should try to impose standards on collectors in the field. DuPonceau and Gallatin not only argued that flexible instructions would produce better linguistic data; they also conceived of this project as a methodological experiment, an effort to fashion a distinctly American approach to science. Thus while their vocabulary avoided disciplining how informants collected knowledge, DuPonceau and Gallatin nevertheless hoped these instructions might offer a model for structuring national science on the whole.

Author: Abel Streefland

Title: Dreams of Transnational Uranium Enrichment: International Ambitions of the Dutch Ultracentrifuge Program, 1955 - 1962

Abstract: Since its start in 1955 the Dutch gas centrifuge program for the enrichment of uranium oriented itself towards other programs, especially the German projects. Scientists hoped to bring their separate endeavors together in a transnational “club” for gas centrifuge research. As the different programs did not know how far the others had advanced, the exchange of

knowledge was necessarily tentative and gradual. Firstly, information on centrifuge patents was to be exchanged, and secondly more specific technological information, in both cases on the basis of reciprocity. In the end, the aim was to arrive at a full cooperation, in which knowledge could flow freely between the different groups. The dream was to create a transnational network of centrifuge scientists. The obvious platform for this cooperation was Euratom. However, the role of this recently signed European treaty was double-faced. On the one hand, Euratom could provide major financial and organizational support. On the other hand, distribution of centrifuge knowledge to, specifically, France and Italy was unwanted. As the technology could also be used for the production of highly enriched uranium, usable for the production of atomic bombs, the dissemination of technological gas centrifuge knowledge became a political issue. Discussions were interrupted by the visit of an American delegation that requested both the German and Dutch governments to classify the gas centrifuge technology as secret. When the officials complied with this request, the dreams of transnational cooperation were scattered. It would take years before the international discussions on gas centrifuge cooperation reappeared.

Author: William Summers

Title: The Early Years of the American Phage Group: Replication of the Delbrück Seminar in Berlin?

Abstract: The canonical origin account of molecular biology as having been born of the mind of The Physicist persists in the lore of this discipline, and this account has been reinforced and legitimated by presentist and persistent recollections of participants in celebratory volumes honoring its founders. A remarkable collection of essays by the followers of Max Delbrück was assembled in 1966 by three of his associates (John Cairns, Gunther Stent and James Watson) on the occasion of his 60th birthday. This volume of essays (*Phage and the Origins of Molecular Biology*) has come to be regarded as the “official” history of the group of scientists known as “The American Phage Group” (APG) and by extension the history of molecular biology. The centrality of Delbrück in this history is frequently traced to his co-authorship of “The Three Man Paper” published in 1935 and in his casting of the “problem of the gene” in strictly physical terms. While the story of Delbrück’s introduction to bacteriophage at Caltech in the late 1930s is well-known, the formative years of the APG in the early 1940s are yet unexamined and represent a development of a small “club” of phage workers organized along the same lines as Delbrück’s informal collective in Berlin which led to the “Three-Man Paper.”

Author: Claudia Swan

Title: On the Same Page: Early Modern Collection and Inscription

Abstract: The literary remains of Dutchman Ernst Brinck (1582-1649) include his *Adversaria* (nearly fifty notebooks, in the Streekarchivariaat, Harderwijk, currently undergoing digitization) and three *alba amicorum*. In the latter, the exceptionally well-preserved three volumes of signatures and inscriptions in the Koninlijke Bibliotheek, The Hague, Brinck collected signatures of contemporary luminaries as well as examples of as many as two hundred languages. His *Adversaria* contain extensive textual annotations and observations of natural historical phenomena, travel accounts, and multiple lists and indices of information. Brinck’s literary legacy comprises an extraordinary resource for the study of seventeenth-century practices as varied and as interconnected as reading, collecting, shipping, trade, and travel; and throughout the *Adversaria*, Brinck records and participates in the circulation of knowledge in signal ways. Brinck was an avid collector—of the sorts of texts enumerated here as well as of natural historical specimens. This paper will attempt an analysis of the relationship between the principles undergirding early modern natural historical collecting and the interest in script and inscription. *Alba amicorum* assembled by Brinck and his contemporary Bernardus Paludanus, one of the most renowned collectors in Europe ca. 1600, play a key role. As further examination of French antiquarian Nicolas Claude Fabri de Peiresc’s guidelines for travel will demonstrate, practices of inscription play a key role in the accumulation of collectible knowledge in early modern Europe.

Author: Sarah Swenson

Title: W.D. Hamilton and the Theory of Inclusive Fitness: Constructing a Science of Society in the Post-war Decades

Abstract: Fifty years ago, in 1964, W.D. Hamilton published a pair of papers detailing his theory of inclusive fitness, which remains a cornerstone of biology today. Seeing social behavior from the gene’s eye view, Hamilton claimed that altruism was no more than enlightened self-interest: by benefiting related individuals, it ensured that shared genes would be passed to future generations. Despite the reluctance with which his ideas had been met until that point, Hamilton was confident that the publication of his theory would mean that its relevance to all of nature, including man, would finally be recognized. Nevertheless, it was not until the late-1970s, after the publications of E.O. Wilson’s *Sociobiology* in 1975 and Richard Dawkins’ *The Selfish Gene* in 1976, that Hamilton’s gene-centered vision of society was widely celebrated. These books proved deeply controversial for their inclusion of man, but the theory of inclusive fitness on which they were based met with

little criticism due to the association it was seen to have with social insects. Close attention to Hamilton's rich archive, however, shows the inaccuracies of this assumption. For this reason, my paper will revisit the enduring image of Hamilton as an objective naturalist and shed light on the true motivations behind his graduate work. Through an examination of the authority granted to Hamilton's ideas, and post-war genetics more generally, in what has been called the age of biology, I will demonstrate the extent to which they infiltrated both academic and political discussions in meaningful and previously unacknowledged ways.

Author: Edith Sylla

Title: Mechanics and Mathematics in Peurbach's Theoricae Novae Planetarum

Abstract: The first edition of Georg Peurbach's Theoricae Novae Planetarum, published by Johannes Regiomontanus about 1472, is remarkable for its figures, labeled theoricae. For the Sun and for the superior planets and Venus the first two theoricae belong together and represent orbs as rigid, thick, three-dimensional rotating bodies, carrying the planets or their epicycles tightly fitted within spherical cavities. The second theorica in each case shows that the axes of rotation of these rigid orbs are horizontal and the rotations come up out of the page. Then the third, or the third and fourth theoricae, represent not rigid physical orbs, but purely mathematical lines and proportional minutes useful for interpolation to represent the changing apparent positions of the planets. Adalbert of Brudzewo's commentary on Peurbach's Theoricae Novae Planetarum makes it clear to the reader that complementary, on the one hand mechanical and on the other hand mathematical, methods are being presented to allow tracking of the positions of planets. The mathematical entities mentioned such as lines and points are understood to be products of the minds of mathematicians, not entities existing in the external world that could exert any kind of causality.

Author: Fenneke Sysling

Title: Tracking the Nineteenth-Century Self: Self-Monitoring and Phrenology in the U.S. and the Netherlands

Abstract: This paper is part of a research project that looks at the historical trajectories of today's self-monitoring activities such as tracking sleep patterns, physical performance or calorie intake with the latest apps. Individuals in the west have monitored their own bodies and habits since the nineteenth century - by keeping a diet diary for example. Scientists such as medical doctors and phrenologists were also interested in their subjects keeping records of their own lives. Besides giving the scientists the data they needed, self-monitoring taught individuals about their bodily selves, knowledge which could potentially improve their lives. In Britain, Francis Galton had visitors measured during the International Health Exhibition in 1884, and immediately presented them with the results. This, according to Frans Lundgren, transformed 'the visitors' self-understanding by engaging them with various techniques of scientific observation'. Likewise, phrenology was a 'science' which engendered reflection of individual participants on their own bodies and selves. This paper compares phrenological cases from the U.S. and the Netherlands in which individuals had their bodies quantified. How were their perceptions changed? By analysing these nineteenth century modes of self-examination, I hope to contribute to a long term history of self-monitoring and to point to continuity and change in the way people get to know their selves and produces new selves through quantitative data.

Author: Henrik Kragh Sørensen

Title: Mathematics and the Sciences: Two-Way Interdisciplinarity

Abstract: Since the early modern period, the interrelations between mathematics and the sciences have been multifarious. At various times, the alternative to "pure", autonomous mathematics has been described as "mixed mathematics", "applied mathematics", "mathematical physics" or "mathematical modelling". These conceptions, however, all hinge on a notion of mathematics being *applied* in the sciences in ways that diminish the feedback into developments within the "purer" branches of mathematics. This conception has found widespread representation in the historical and philosophical narratives about mathematics over the past centuries leading to Wigner's view of the miraculous applicability of mathematics in the sciences, a strong tradition in the history of nineteenth-century mathematics of focusing on themes of rigorisation and axiomatisation, and a partial alienation of history of mathematics and of science. However, with the recent historical and philosophical interest in interdisciplinarity, the ubiquitous role of mathematics in very large parts of sciences over the past centuries provides a testing ground for a number of philosophical and historical conjectures. In this talk, I will first outline the framing of applications mathematics in the sciences and briefly discuss its historiographical and philosophical implications. I

will then discuss examples of interrelations between mathematics and the sciences that defy the one-way application theme and seek to interpret these as examples of interdisciplinary research that essentially involve mathematics. Finally, I will outline a perspective on a historiography of mathematics and the sciences that can better accommodate this two-way relationship.

Author: Yingjia Tan

Title: Electricity and China's Military-Industrial Complex, 1937-1957

Abstract: China's electrical power industries experienced violent beginnings during decades of war and political upheaval particularly in the first half of the twentieth century. During its formative years, physicists and engineers who built China's electrical power systems responded to the demands of the Nationalist Revolutionary Army, Japanese Imperial Army and the People's Liberation Army. This paper explores the role of electricity in the formation of the Chinese military-industrial complex, which in the words of sociologist C. Wright Mills means "the political economy, linked in a thousand ways, to military institutions and decisions." I identify three distinct phases in the evolving relationship between electrical power and the military. During the war between the Chinese and Japanese from 1937 to 1945, electrical engineers and physicists in China developed the electrical industries in accordance to the demands of the defense industries. . During the Civil War, both Nationalist and Communist military battled for control over electrical utilities, as they sought the intellectual and technological resources necessary for a national government. As the Communists secured the defection of the Nationalist's engineer-bureaucrats, the military became a patron of the electrical industries by offering military protection and providing the engineers with a personal connection to the national leadership. After 1949, the military leaders presided over the electrical industries and made all high-level decisions about the allocation and use of electricity, while the old engineering elite became "servants of the revolution." Electricity became an integral part of military science in modern China.

Author: David Teira and Juan M. Suay

Title: Kites: The Rise and Fall of a Scientific Object

Abstract: Between 1753 and 1914, kites were used as scientific objects in different branches of physics. First, as experimental instruments in electrical experiments. Then, still in the 1750s, we find theoretical models of the flight of kites. In the late 19th century, sophisticated technological kites were also used for aerological measurement. Finally, at the turn of the past century, kites served early aeronautical researchers as scale models of wings. In all cases, there was a rise and a fall: kites were reasonably successful in all these roles, but they could not produce interesting enough results to stand the competition of more efficient alternatives. We want to explore why kites did not achieve a permanent status of scientific objects (in Daston's terms). We contend that kites did not lead to any kind scientific error: Franklin's experiment was correctly replicated; kites delivered reliable aerological observation and successful scale models of wings. Even in rational mechanics, Euler's models were as good as those of any other hydraulic machine. However, in every case, kites lacked productivity (again in Daston's terms): either they yielded no further results (as it was the case with electrical kites) or they were soon replaced by more efficient alternatives (as in aerology and aeronautical research). Hence, kites were not left aside by science with a reservoir of epistemic potential yet to be exploited. We conclude that scientists abandoned kites for good epistemic reasons.

Author: Mary Terrall

Title: Indigo in the Laboratory: Michel Adanson in Senegal

Abstract: In 1749, at the age of twenty, Michel Adanson sailed from France to Senegal on a French East Indies Company ship. Under the auspices of the Company, he planned to establish his reputation as a naturalist by studying the natural history of the West African coast. For nearly five years, he lived and worked in Senegal, where he functioned as a valuable node in the scientific networks of the Jussieus, at the royal botanical garden in Paris, and of Réaumur, at the Paris Academy of Sciences. While sending specimens back to France for his mentors' collections, Adanson was also trying to improve his own situation by appealing to the commercial interests of the Company. To this end, he devoted considerable effort to learning about African species of indigo, and about local methods of cultivating and processing the plants for textile dyes. His experimental investigations took place in an ad hoc "laboratory" near his residence and garden near the fort of Saint-Louis. This paper locates Adanson's work on indigo in the interlocking networks of science, technology, commerce and artisanal practices that made natural history possible in the eighteenth century. We can situate these experiments and observations in the local context of the African villages and gardens where Adanson found his samples and his informants. The experiments

also belong to a larger-scale geography of knowledge connecting Adanson in Senegal back to Paris, and to the commercial and political landscape of global trade in African, American and Asian commodities (including slaves).

Author: Courtney Thompson

Title: “Directly at War with the Gallows”: Phrenology in the Prison, 1830-1860

Abstract: Phrenology developed a complex relationship with penal spaces in early nineteenth-century America. Practical phrenologists, like the Fowler brothers, aligned themselves with a growing reform position and spoke out in favor of prison reform and against capital punishment. At the same time, however, the Fowlers, like the originators of phrenology, Franz Gall and Johann Spurzheim, frequently entered prisons and used the bodies of prisoners as research subjects to produce proofs of their science. While phrenologists became a part of a popular anti-capital punishment coalition, they also benefitted implicitly from this apparatus of crime and punishment. Indeed, a regular terminus of the rake’s progress through the criminal justice became the phrenological post-mortem, in which the executed felon’s head would be measured, examined, denuded, and cast as a death mask for further study as a part of a phrenological cabinet. The growth of the phrenological cabinet and the status of the phrenologist depended directly on access to and use of prisons as research sites and the bodies of convicts as research subjects. In this paper, I explore these contradictory uses of the prison, examining in particular the dislocation between reformist discourse and exploitative practice. I argue that while phrenologists could boldly declare themselves to be “directly at war with the gallows,” their position on capital punishment was based primarily, and somewhat ironically, on the scientific study of bodies and skulls culled from gallows and prisons alike.

Author: Christy Tidwell

Title: Taxidermy and Science Education: From Carl Akeley to Emily Graslie

Abstract: For over a century, taxidermy has been a way of revealing animals to people who might not otherwise see animals in the wild. Carl Akeley’s taxidermy and habitat dioramas for the Field Museum and the American Museum of Natural History in the early 20th century represented a shift in the public’s understanding of natural history, wild animals, and museums themselves. His focus on presenting animals in a simulacrum of their natural habitat allowed viewers to gain a more holistic understanding of these animals. Throughout the 20th century and into the 21st century, Akeley’s educational goals and physical techniques have had a significant impact on scientific education and museum curation. Now, in the 21st century, another shift is under way, represented by Emily Graslie and *The Brain Scoop* (on youtube). Graslie is young, enthusiastic, and invested in making science and natural history accessible to a generation of viewers for whom museums no longer seem as appealing as they did to Akeley’s contemporaries. Although Graslie has not (yet) developed the kind of groundbreaking techniques that Akeley did in the 20th century, her use of new media to propagate older forms of knowledge extends Akeley’s work in science education and provides a different, behind-the-scenes view of museums. In this paper, I will examine the significance of considering Graslie as a successor to Akeley. In what ways does she simply continue his work and in what ways does she complicate or challenge his work?

Author: Corinna Treitel

Title: Life Reformers and Laboratories: On Nutrition Science in Modern Germany

Abstract: Nutritional prescription has a long and complex history that stars scientists and non-scientists alike. In Germany, where much of the intellectual scaffolding of modern nutrition science was built, this has been especially true. Since the mid-nineteenth century, Germany has been one of the world’s most vibrant centers of research in chemistry and physiology. At the same time, it has housed one of the largest and most continuous popular movements for refashioning modern lifestyles. The Lebensreform (life reform) movement, as it was known, included vegetarians, naturopaths, nudists, clothing reformers, and others dedicated to mitigating the negative effects of industrial modernity through reform diets and other popular health practices. This paper will consider the interaction between life reformers and nutrition scientists with an eye to recovering the process of critique and borrowing that unfolded between them on the question of what role meat / protein should play in Germany’s nutritional future. Scientists used life reformers in their labs to test new hypotheses about protein, while vegetarians used scientists to gain legitimacy for their culturally deviant practices and to correct what they saw as scientific error. The paper will compare experiments done on vegetarians by the chemist Carl Voit in 1889 and the physiologist Wilhelm Caspari in 1903-5 to gauge how this relationship of mutual antagonism and co-optation worked at century’s turn.

Author: Scott Trigg

Title: Fathallah al-Shirwani and the Transmission of Science from Samarqand to Istanbul

Abstract: My talk explores a previously-unstudied text in Islamic astronomy written by the 15th c. scholar Fathallah al-Shirwani, al-Fara'id wa-'l-fawa'id fi tawdih sharh al-Mulakhkhas. Shirwani was a student of Qadizade al-Rumi at the Timurid sultan Ulugh Beg's madrasa and observatory in Samarqand, and spent most of his career teaching and traveling in Anatolia, Cairo, Iraq, and Central Asia. The text under consideration is a supercommentary on Qadizade's commentary on Jaghmini's al-Mulakhkhas fi 'ilm al-hay'a al-basita, an early-13th c. elementary astronomy treatise meant as a simplified introduction to the mathematical and philosophical concepts required for more advanced studies. Shirwani based this Arabic-language work on notes he took as a student in Samarqand, in addition he drew on earlier commentaries and his own experience as a teacher under the patronage of Anatolian notables in Kastamonu and Bursa, including the Ottoman Grand Vizir Khalil Pasha. He completed the text after the conquest of Constantinople and dedicated it to Sultan Mehmed the Conqueror. In my talk, I focus on Shirwani's role in the transmission of science from Central Asia to Anatolia and the insights his text provides on the nature of education in the rational sciences in this period.

Author: Brian Tyrrell

Title: Blueprints and Bricks: DNA and the Origins of the DNA Nanotechnology Community

Abstract: James D. Watson referred to DNA as the "secret of life" because of the biological information stored within its double helix (Watson 2004). Biologists have worked since the 1950s to unlock this secret. But, beginning in 1982, an emerging group of researchers has been looking beyond the secrets encoded within DNA and focusing instead on its utility as a structural material. Consequently, a community of researchers from broad disciplinary backgrounds has converged to study how to use DNA as the raw material for constructing passive as well as active nano-scale structures. Drawing researchers from biology, chemistry, physics, and computer science, advocates for this "DNA nanotechnology" say these techniques hold the promise of new types of computing and revolutionary pharmaceutical delivery mechanisms. This paper traces the formation of a research community dedicated to DNA nanotechnology. As this group began to see DNA as something other than genetic material, new types of training, community structures, and disciplinary norms emerged which emphasized the chemical structure of DNA over its genetic data. DNA provided these scientists not only with raw material for de novo structures, but also with a blueprint for a new scientific community with its own professional organizations and identity. This paper argues that how scientists conceive of DNA has implications for how they conceive of themselves.

Author: Steven Van der Laan

Title: Artificial Insemination in Dutch Pig Breeding: A Hard-Won Success

Abstract: Artificial insemination is arguably the most successful innovation in the history of Dutch pig breeding; as of today, AI accounts for over 98% of all inseminations in the Netherlands. This, however, is a rather recent development. While AI was already practiced on a large scale by breeders of dairy cattle in the nineteen-fifties, it was not until thirty years later that AI became a dominant practice in pig breeding. Potential explanations to this can be found among the many technical obstacles that had to be overcome before AI could be implemented reliably. Yet, although the technique was far from perfected and still in need of fundamental research, the first AI associations started to appear in the sixties and there was a steady, albeit small, number of pig breeders who consequently applied AI. AI in pig breeding was therefore not exclusively the domain of scientific experts, but was also frequently discussed by men of practice in various agricultural journals. This specific development, in which, according to one contemporary, 'science lagged behind the daily practices of breeders', will serve as a case-study to find out how and by whom the basis was laid to the widespread adaption of AI in pig breeding in the 1980s.

Author: Jeroen van Dongen

Title: A Virtuous Theorist's Theoretical Virtues: Einstein on Physics vs. Mathematics and Experience vs. Unification

Abstract: When Albert Einstein formulated the general theory of relativity, he combined a physical and mathematical approach, as Renn and his collaborators have shown. He retained and explicitly referred to these categories in his later work in unified field theory, but emphasized their usefulness differently, just as his later recollections of how he found general

relativity gradually changed. These altered recollections were not only the consequence of his new, highly mathematical unification program, but also served as an advertisement for that program: Einstein pressed idealizations of himself into service to help justify his controversial program.

Author: Joppe van Driel

Title: Circulating Filth: Chemical Accountancy and Waste Management in the Eighteenth-Century Dutch Republic

Abstract: Chemistry was central in shaping eighteenth-century political economy. This paper examines the interconnection between these fields by analyzing the development of what eighteenth-century actors called an ‘oeconomic’ cycle, integrating agriculture and industry by allocating filth (vuylnis) from Amsterdam as fertilizer in rural areas for the production of vegetable raw materials that in turn supplied urban factories. This way, the paper demonstrates how in practice the state controlled husbandry of resources went together with liberal visions of self-regulation – two ideals that in current historiography are ascribed to the oppositional discourses of mercantilism versus liberal political economy. Dutch political ‘oeconomy’ referred to a loosely defined strategy to maintain what was called the circular ‘sustainability’ (duurzaamheid) of production and commerce through the thrifty husbandry of resources. To pursue this, administrators and entrepreneurs fostered chemistry as an accountancy practice with corresponding objectives: calculating material exchanges that integrated agriculture and industry and teaching citizens their mutual responsibility. Chemical accountancy thus provided an impetus for the state controlled allocation of industrial wastes and night soil at the beginning of the nineteenth century, shaping a lively market for filth. In the process, oeconomy had acquired a more specific meaning, referring to the self-regulating moral order that sustained the circulation of materials within a bounded domain.

Author: Frans van Lunteren

Title: The Conservation of Energy in the Netherlands

Abstract: Among the several unifying principles that emerged in nineteenth-century science two stand out for their far-reaching implications: Darwin's theory of evolution and law of the conservation of energy. Whereas the comparative reception of Darwin's work has been widely studied, little attention has been given to the European spread of the new concept of energy and the corresponding law. In my talk I will discuss the introduction of energy conservation in the Netherlands during the third quarter of the nineteenth century. As the Dutch case makes clear the concept of energy itself was fraught with difficulties. Its gradual appropriation by Dutch academics involved an amalgam of different routes and strategies, involving popular lectures, heated arguments, new text books and even the introduction of a distinct terminology. In this process both the concept and the law were gradually sharpened and cleared of ambiguities, nicely illustrating how the circulation of knowledge is indeed inextricably bound up with the production of knowledge. One of the examples I will discuss is the divergence of opinion between the Dutch physicists as J. Bosscha and J.D. van der Waals on the 'potential energy' of a fluid. The results of their discussions would crop up in Vander Waals famous dissertation on the continuity of the gaseous and liquid states as and in Bosscha's highly influential physics textbook.

Author: Jeannette Vaught

Title: Envisioning Living Tissue: Race, Animality, and Conflicts Over Vivisection in 1920s America

Abstract: Medical research and education in turn-of-the-twentieth-century America relied heavily upon vivisection in the laboratory, putting the scalpel to live animals in the service of human medicine. While antivivisectionists mounted a significant attack on the practice for several decades, the majority of established practitioners defended vivisection as a keystone of modern medical science. Vivisection reflected a scientific paradigm based on the assumption that sight conferred knowledge; that performing a live experiment was the best way to perceive the living body. However, what the defenders of vivisection also assumed is that knowledge of the human body could be gained from seeing the animal – visual and visceral as part and parcel. By 1915, the New England Anti-vivisection Society often railed against this equation of the animal with the human body in the pages of their monthly periodical, *Living Tissue*. Vividly countering with a pro-vivisection view was William Williams Keen, a Philadelphia brain surgeon and one-time president of the American Medical Association, who appeared editorially in *Living Tissue* and wrote his own books on the subject. This presentation investigates the arguments between Keen and the antivivisectionists, who disagree fundamentally on whether one can see the human in the body of the animal. Both sides engage troubling conceptions of race to explain how, once divested of “animal” features, skin, and fur, the animal body can or cannot be seen in human terms. The subversion of a human/animal binary to produce scientific knowledge exposes cultural anxieties inflecting what could be known about bodies.

Author: Anne Vila

Title: The Animal Within: “Internal” Sense, Instinct, and Psycho-Physiology in France, 1765-1832

Abstract: As Pierre-Jean-Georges Cabanis remarked in *Rapports du physique et du moral de l'homme* (1802), the ideas attributed to the notion of "internal" sense were many and varied; and, as he saw things, it was up to physiology to pin down the meaning of the term with greater precision. This paper will explore some of the ways in which senses like "tact," "taste," and vision were internalized by French medical theorists and physiologically-oriented literary writers, from the Montpellier physicians who contributed to the *Encyclopédie*, to Honoré de Balzac. After a brief survey of the *Encyclopédie* articles "Sens interne" and "Sensibilité," I will consider Denis Diderot's use of the idea of organically local tact, focusing on his descriptions of the eye and organic instinct in *Les Eléments de physiologie*. I will then examine a pair of articles written by Julien-Joseph Virey for the *Dictionnaire des sciences médicales* (1818): "Instinct" and "Magnétisme animal," which show how central the idea of "internal sense" was to contemporary debates on a range of topics, including philosophical reflections on the boundaries between the animal and the human, and the claims which contemporary medical magnetizers made about the capacity of certain patients to experience the "transport" of external senses into inner organs. If time allows, I will also consider the theories of "instinct" and "instinctivity" which Balzac proposed in his 1832 novella *Louis Lambert*.

Author: Paola Villa

Title: Wired Bodies and Sensitive Machines: Neurotic Identities of Italian Telegraph and Telephone Operators at the Turn of the Twentieth Century

Abstract: The analogy of the nervous system to a telegraph or a telephone system is a well-established trope that informed many reflections on the new telecommunication systems since the end of the nineteenth century. In Italy, for the initial 40 years of its operation, the telephones lines were running on the same wires as the telegraphs and shared many of the same regulations generating a “con-fusion” of the social and even political reception of the two systems. If telegraphs and telephones were represented in the media as organic threads running across the nation, their “vitality” was often shadowed by a fear of de-humanization of its users and, most of all, of its female operators. Through literary examples, a corpus of laws, psychological studies and the first advertisements, I propose an analysis of the new social identity embodied by the women of the telegraph and the telephone as incarnations of “modernity” and its neurosis. Due to the long hours in contact with the new machines and to the lack of labor laws to protect their working statuses, these women took the brunt of modernity as society was calibrating the effects of the new “electrical” communications.

Author: Axel Volmar

Title: Auditory Data Analysis: Epistemic Listening Practices and the Formation of Scientific Sonification, 1960s–1990s

Abstract: In order to enhance our understanding about the role of the senses in making sense of abstract “data” structures, this paper aims to reflect and historicize the relationship between technologies of data production and sensory practices of data analysis. In particular the history of scientific listening and “data sonification” will be addressed. Sonification is defined as the “use of non-speech audio to convey information” and is usually accomplished by “transcoding” digital data into audible sounds which then may be analyzed by trained listeners. By studying the field of sonification I intend to raise questions about how emerging possibilities of digital signal processing led scientists to develop new visions of analyzing scientific data by bringing together digital technologies and trained ears. In the face of exponentially growing digital archives from the 1960s to the 1990s, the question of how to make sense of large data sets became a critical issue in computer science and other disciplines. I will discuss some examples of how and why the ear was used to acquire, represent, and construct new knowledge from digital data by means of auditory displays using sonification methods. By reconstructing the development and institutionalization of sonification as a research field, I aim to illustrate a major shift within the recent culture of scientific listening, a shift best characterized as a turn away from listening to physical signals, i.e. bodily sounds or the clicks of a Geiger counter, to the auditory analysis of virtual data structures in data sonification.

Author: Mark Waddell

Title: Between the Miraculous and the Mundane: The Jesuit War on the Occult

Abstract: During the seventeenth century, while proponents of the “new philosophies” embraced insensible causes for natural phenomena, a number of prominent Jesuits also turned their attention to the hidden and occult parts of nature. Unlike many of their contemporaries, however, men like Niccolò Cabeo (1586-1650), Gaspar Schott (1608-1666), Francesco Lana de Terzi (1631-1687), and Athanasius Kircher (1602-1680) were not content with occult explanations for observed phenomena. Instead, they each worked to reveal nature’s secrets to audiences across Europe, speaking out against the Aristotelian doctrine of occult qualities while finding novel and sometimes spectacular ways to render visible the secret workings of nature. This Jesuit program of revelation can be explained, in part, by a wider preoccupation within the post-Tridentine Church, one that sought to redefine the standard ontology inherited from medieval scholasticism and to challenge in particular the troublesome category of the preternatural.

Author: Matthew Wallace

Title: Geographies and Policies of the Arctic Atmosphere: The Emergence of a Research Specialization in Canada

Abstract: Scientific research in and on the Canadian Arctic flourished in the post-war years, both in the context of the Cold War and of Canada’s quest to explore, exploit and understand its vast territory to the North. With new observation stations and aviation capabilities, meteorological and climatological studies of the Arctic also became more feasible. This was essential for the human exploration of the region, for strategic defense of the continent and for understanding global atmospheric circulation. In this paper, we examine the role the Canadian government, the United States Air Force, the Arctic Institute of North America and McGill University in developing Arctic meteorological research in Canada. Just as a confluence of interests led to the Arctic atmosphere becoming a new “space” of scientific value, Montreal—both at the University of McGill and the offices of the Meteorological Service—became one of the main “spaces” for this research in North America over the course of the 1950s and 1960s. In particular, we focus on the public policies and organizational priorities at play, and on central actors at the interface of scientific, university, civilian and military spheres. From this vantage point, we characterize the development of new types of meteorological research (e.g., combining climatology and dynamic meteorology) and new modes of organization (e.g., university-government collaborations), within the broader context of a nascent research community in Canada in meteorology, a well-established field south of the border.

Author: Zuoyue Wang

Title: Going to Taiwan: Chinese American Biomedical Scientists and US-Taiwan Scientific Exchanges

Abstract: In 1949, when the Chinese Nationalists lost the civil war to the Communists and retreated to Taiwan, there were about 5000 Chinese students and scientists, many of whom had been sponsored by the Nationalists, were now stranded in the US. In the 1950s, about 1200 returned to mainland China while most of the remaining stayed in the US. Perhaps surprisingly, very few of these students/scientists went to Taiwan. Yet, in the 1950s and 1960s and beyond, the Nationalists launched many efforts to attract and recruit elite Chinese American scientists to visit if not to stay, both to help with its scientific, technological and educational institutions and programs but also to claim and demonstrate the loyalty of Chinese Americans for the Nationalists in the increasing bitter Cold War with the mainland. While physical sciences received more publicity, Chinese American biomedical scientists actually played an active role in promoting exchanges with Taiwan and developing its scientific capabilities and in turn attracted more students from Taiwan to the US. This paper explores the experiences and roles of such Chinese American biomedical scientists as Choh Hao Li and Monto Ho in US-Taiwan scientific and educational exchanges. It argues that such interactions did not only benefit those in Taiwan but also provided an outlet for these Chinese American scientists to maintain a sense of connections with a cultural home and in many ways strengthened their sense of Chinese cultural Nationalism.

Author: Iain Watts

Title: Information Starvation and Experiment in the Age of Revolutions

Abstract: In the decades around 1800 the amount of information on science in print increased rapidly both for specialist and general readers. New publications, particularly a set of fast-paced monthly journals, from Crell’s *Chemische Annalen* in Germany to the *British Philosophical Magazine*, linked up widely-dispersed groups of scientific practitioners who had previously lacked a centralized venue for community exchanges. Such publications were particularly important in the experimental sciences, and above all for chemistry and galvanic electricity, fast-moving endeavors in which experimenters all over Europe were producing a large number of “new facts.” Nonetheless, this talk argues that when we take seriously how this new print landscape appeared from the perspective of the day-to-day practice of experimental science, the picture which emerges is not one of “information overload” (rarely complained of) but rather a series of responses to a pervasive sense of

information starvation: i.e. a preoccupation with the failure of the right information to reach the right people on time. The shift is achieved through a careful look at how men of science around 1800 themselves understood “information” – not as stored “data,” but rather as the time-sensitive communication of new facts across distance. The argument is developed with several detailed examples of transnational experimental work in galvanic electricity in the first decade of the nineteenth century, during the disruptions of the Napoleonic wars. Fear of information starvation in the scientific world can be seen at work in multiple projects for scientific communication in this period, (including the new journals themselves).

Author: Milena Wazeck

Title: Assessing Acid Rain during the Reagan Years: The US National Acid Precipitation Assessment Program

Abstract: In 1980, the US National Acid Precipitation Assessment Program (NAPAP) was created to assess the causes and effects of acid precipitation, and to provide information relevant for policy making. NAPAP was the most controversial acid rain assessment of the 1980s, leading to heated debates about scientific integrity and the boundaries between science and policymaking. This paper examines why, and addresses the question of how scientists assess scientific knowledge and cope with uncertainty when their assessment is embedded in an overtly political debate. I argue that institutional settings and the political context of the Reagan years significantly shaped NAPAP’s development, and accounted for the fact that the US acid rain program assessed acid deposition more cautiously than its European or Canadian counterparts. In a political environment that was hostile towards environmental protection, NAPAP researchers focused on producing “objective science” rather than on assessing scientific knowledge for policymaking. When NAPAP’s Interim assessment was published in 1987, it was extremely cautious, reflecting the demand for a high degree of certainty about the nature and effects acid deposition that dominated the political debate. Finally, I draw some general lessons from NAPAP’s performance: Interests of the actors in doing the assessment (“push”), interests of policymakers or the public in receiving the assessment (“pull”), and changing information needs and political priorities can change both the external relevance of an assessment and its internal dynamics.

Author: Colin Webster

Title: Heuristic Medicine: the Methodists and Galen

Abstract: In the first century BCE, a school of medical thought took hold in Rome. These so-called Methodists declared it unnecessary to discover the hidden causes of diseases, which were thought “good to enhance learning,” but ultimately useless for the practice of medicine (Soranus, Gyn. 1.2). Instead, they insisted that diseases could be broken down into three simple types: those of stricture, looseness and mixed. These types, in turn, could be identified by easily observable “commonalities” that would reveal the appropriate treatment. In other words, these physicians applied what Gigerenzer and Sturm (2012) have called a “heuristic.” This paper suggests that in accepting their practical and epistemological limitations, the Methodists reveal several crucial aspects of theory-formation in (ancient) medicine: excluding information, restricting potential causal mechanisms and creating operational frameworks. While their views made the Methodists a considerable number of enemies, including Galen, who considered their rejection of etiology antithetical to medicine as a discipline, I argue that their embrace of a “bounded rationality” provides a window into how knowledge and authority are constructed in a marketplace of medical ideas.

Author: Catherine Westfall

Title: Jefferson Laboratory Sets Intent Into \$500 million of Concrete: Desire, Bureaucracy, and Innovation in the New Big Science

Abstract: From the 1950s through the 1970s desire rose for an accelerator capable of high enough precision to enable finely detailed studies of nuclear structure as well as the quantum structure of nucleons and nuclei. In the early 1980s, a sizeable community of physicists conjured a wish list of experiments they longed to conduct. After a competition to choose the design and builders, a group of Virginia physicists began preparations in 1982 for Jefferson Laboratory (JLab) in Newport News Virginia to make these wishes come true. In the next four years potential users and a growing staff at the \$500 million Department of Energy laboratory crafted increasingly solid plans for the laboratory’s experimental program, plans that had to pass muster with a dizzying array of advisory committees in line with U.S. government accountability practices. Bureaucrats, research physicists and equipment experts criticized, advised, and finally approved plans in 1990. JLab staff and potential users subsequently built and commissioned equipment, a Program Advisory Committee ironed out an approved list of experiments, and experiments proceeded from 1995 to 2012. How does the actual experimental program compare with the original wish list? This talk will answer that question, along the way showing how scientific knowledge is actually created in the New Big Science that emerged in the U.S. after 1980.

Author: Elizabeth Williams

Title: Silent Need, Clamorous Appetite: Civilization and the Degradation of Needs in Early Nineteenth-Century French Physiology

Abstract: For well over a century after he urged laboratory experimentation as the means to advance physiology, François Magendie stood as an exemplar of methodological rigor in the life sciences. Even in very recent studies of one of his key problems—the nature of hunger—Magendie’s work is celebrated as the point of departure of modern inquiry. Despite such tributes to Magendie’s place in exploring the “internal sensations” propelling ingestion, one central issue is said to have taken shape only later in the nineteenth century with recognition that the instinctive capacity of animals to select appropriate foods degrades under the impact of domestication. In this paper I argue that an analogue of this theme is to be found in the work of Magendie and other French physiologists of the early nineteenth century who struggled to define the boundaries between “need” and “appetite” and who postulated that human beings in highly civilized states lost the capacity to experience “genuine needs” amid the clamor of over-refined or artificial eating desires. I suggest that this moralizing strand of early physiology, the decrying of the human tendency to develop what Magendie called “capricious tastes,” has enjoyed real staying-power but that, unlike his putative methodological modernism, has remained unacknowledged by later students of the inner prompts of ingestion.

Author: Audra Wolfe

Title: Fashioning a Life as an Independent Historian

Abstract: In the spring of 2009, I left a good job as editor-in-chief at the Chemical Heritage Foundation to start my own editorial and publishing consulting business. This leap into the unknown required some explanation to concerned friends, family, and colleagues. I was, after all, leaving a well-paying position at a reputable history of science nonprofit that valued Ph.D.s in a city that I love. Wasn’t this supposed to be the perfect set-up for a career outside the academy? The problem was that the kind of job that values a Ph.D. may or may not leave time to pursue the things a Ph.D. traditionally does: research and writing. Life as a freelancer, while financially much more risky, has given me the time and intellectual flexibility to pursue research grants, publish articles, and write a book. Through no fault of my former employer, it is doubtful that any of these things would have happened had I stayed in a full-time, non-academic position.

Author: Elizabeth Wolfson

Title: "Feeling Dear Old Egypt": Affect and the Politics of Knowledge in the Archaeological Photographs of James Henry Breasted

Abstract: In August 1919, the American Egyptologist James Henry Breasted departed on a nine month archaeological survey expedition through Egypt and present-day Iraq, Syria, Lebanon, and Israel-Palestine. Breasted's tasks in this trip were three-fold: to purchase objects for the newly founded Oriental Institute at his home institution, the University of Chicago; to visit ongoing excavation sites and scout out promising new sites; and to "assess the political situation" in the region following the end of the First World War and the occupation of the former colonies of the Ottoman Empire by British and French colonial forces. This paper examines a selection from the vast photographic archive of nearly 1,900 images Breasted produced in the course of this trip. It uses these photographs to investigate the affective register of the Egyptologist's scholarly interest in the region and its history and culture. Ultimately I argue that the politics of knowledge that link Breasted's project with a broader history of imperialist ambition and activity in the area cannot be fully understood without attention to the various forms of emotional intimacy and affective attachment that, as much as his professional scientific training, shaped the character of his scholarly labor and attention.

Author: Paul Wolfson

Title: Mathematics, Mechanics, and the Calculus Controversy

Abstract: The conflict between the Newtonians and Leibniz is often portrayed as a dispute over priority for the invention of the calculus. It was that, of course, but it was much more; the participants differed on matters of theology, natural philosophy, and mathematics. During the protracted conflict, Newton published the first and second editions of his Principia. By examining a few of its propositions and contrasting Newton’s approach with that of some continental mathematicians we can

infer some of the differences between the two schools concerning mathematical methods and values. Unlike Leibniz, Newton held an inchoate philosophy which related mathematics closely to mechanics.

Author: Jung H. Won

Title: Building Identities as Geologists in Liberated Korea by Dissociating Themselves from Japan

Abstract: Under Japanese colonial rule (1910~1945), ten Koreans graduated from the geology departments of the imperial universities in Japan. After coming back to Korea, most of them worked as engineers in the Japanese-owned coal mines, delivering raw materials to Japan. After Liberation, geology departments were opened at some newly established Korean universities and these Korean engineers were appointed as professors. They needed to identify as geologists instead of engineers. But it was delayed because of the Korean War (1950-1953). Their chance came when President Park seized power through a coup d'état at 1961. Park tried to justify his rule through rapid economic development and ordered to survey mineral resources of Korea. The professors actively participated in the survey project and that was the decisive moment for them to prove their agencies as "Korean" geologists. This study traces the way Korean geologists built their identities as scholars. Their first task was to make geological maps of Korea. While comparing their maps with the ones drawn by the Japanese geologists under Japanese rule, they found many errors. Even though those errors were technical, caused by the new standard marking system of the IUGS (International Union of Geological Sciences), Korean geologists regarded the as remnants of colonialism. I argue that this was how Korean geologists established their identities: consciously disconnecting themselves from Japan and promoting their work as something "Korean." This study gives insight into the way scholars of the colonial peripheries constructed their scholastic identities after the colonial period.

Author: K.A. Woytonik

Title: Lying-In: Obstetrical Space and Authority in Nineteenth-Century Philadelphia

Abstract: As early as the founding of the Pennsylvania Hospital in 1751, physicians discussed providing obstetrical care to patients -- largely indigent residents of Philadelphia. In 1803 the Pennsylvania Hospital opened its maternity ward, and in 1823 the Board of Managers recognized obstetrics as a distinct medical specialty. Physicians of the Pennsylvania Hospital appointed to serve maternity patients promoted their own authority to treat by undermining those providing the same service: midwives. Proponents of professional obstetrics sought to shift childbirth from the domestic realm to the medical by stressing the scientific and anatomical knowledge of physicians as superior to the lay experience of midwives, and communicated this in pamphlets, public lectures, and medical journals. But for all the institutional efforts to move pregnant bodies from home to hospital, women fared worse at the Lying-in Ward. The experiment in institutional maternity ended in 1854 after an outbreak of puerperal fever decimated the patients and sparked outcry, but the incident forced the city's healthcare and social welfare institutions to confront the problem of maternity care in the vacuum left behind by the failed maternity ward, obstetricians and their half-century war on midwives. This paper uses the Pennsylvania Hospital's Lying-in Ward as a backdrop for the professionalization of medical knowledge and space between 1800 and 1860, during which the previous ideal, home care, was dismantled by physician-scholars who viewed the hospital as laboratory and patients as case studies.

Author: Shellen Wu

Title: Mapping the Geography of Modern China

Abstract: Chinese boundaries today follow closely the territorial outlines of the Qing empire. This paper examines the role of geographers in sustaining the discourse of empire under the rubric of the nation. After the official end of World War II, Academia Sinica and all its affiliated scientific organizations, including the Institute of Geography established in 1939, moved back to Nanjing. In a few short years, Jiang Jieshi and the GMD regime fled the mainland to take their last stand on the island of Taiwan, but the regime change made little difference to the scientific imperative of organizations like the Institute of Geography. Shortly after the establishment of the People's Republic, a newly established Chinese Academy of Sciences formed an interdisciplinary committee to continue fieldwork and research of frontier regions. The committee contained among its members geologists, geographers, and other specialists and organized large teams of researchers into the field following in the footsteps of the triumphant People's Liberation Army. Until the entire Academy shut down during the Cultural Revolution in 1966, the joint research committee formulated long term plans with particular emphasis on the exploration of natural resources of frontier regions, divided into the Northwest, Tibet, and the Southwest -- in other words, continuing the research emphasis of the wartime China Geological Survey, Institute of Geography and other scientific and political organizations. The continuation of the wartime research goals reflected the personnel overlap between the PRC Academy of Sciences and prewar and wartime scientific organizations until the late 1950s.

Author: Stacy Wykle

Title: History of Editorial Peer Review in Scientific Journals: Factors Influencing Publication in French and English Scientific Society, 1665-1830

Abstract: Editorial peer review is considered today to be the highest standard to which new knowledge claims are subjected prior to becoming part of the scholarly record. Throughout the development of this sociological process there has been a concomitant stream of complaints and satires that have called for reform. Although the advent of journal publication itself and the development of the research article as a genre have been studied, the history of the editorial peer review process itself has not been comprehensively examined to date. Due to lack of knowledge about peer review's early history, the general assumption appears to be that the Royal Society of London instantiated the practice in an attempt to satisfy the same needs, perceptions, and motivations that inform more contemporary publication oversight. Yet the different characters of the two most distinct and influential scientific societies during the centuries in which editorial peer review was in its pre-professional stages gave rise to networking structures and communication practices that were not homogeneous or synchronous with one another. It is the purpose of this presentation to suggest the most appropriate contexts for the study of the early evolution of editorial peer review in the sciences as related to periodical publication. There is enough evidence to suggest that the sociological and rhetorical epistemologies that have come to undergird the value placed upon editorial peer review actually originated in Paris rather than London.

Author: Caitlin Wylie

Title: (In)visible Technicians, Scientists, and Fossils

Abstract: In most experimental sciences, laboratory technicians' work is recorded – to some extent – in the “methods” section of research publications, and sometimes their names appear as authors. But in vertebrate paleontology, a nonexperimental science, “methods” sections are rare and technicians are almost never authors. These technicians therefore seem particularly “invisible” to the scientific community. An ethnographic investigation of several American paleontology labs reveals that these scientists' and technicians' dynamic concept of (in)visibility simultaneously constructs and enacts paleontology and fossil preparation as separate Bourdieusian fields, with their own sets of doxa, habitus, and capital. Paleontologists and fossil preparators claim to have distinct bodies of expertise, namely scientists' ability to study fossils and write publications vs. technicians' ability to make fossils useful for research, such as by removing rock matrix and reconstructing broken and missing pieces. This separateness of expertise constructs distinct group identities for these workers, which in turn shape their everyday interactions through field-specific language and humor. As a cause and effect of this enacted independence, each group demands control over certain tasks, despite the close interdependence of the work of preparing and studying fossils. I examine possible reasons for this sharp social delineation, based on situations in which each group makes the other “invisible”. Then I suggest how scientists' and technicians' dynamic negotiation of invisibility influences the lab's output of prepared fossil specimens, both in these objects' physical forms and in their epistemological role as the basis for scientists' knowledge claims about Earth history and past life.

Author: Lydia Xynogala

Title: Mendeleev's Maps, Measures and the Magnetic Mountain

Abstract: This paper traces Dmitrii Mendeleev's 1899 report from his trip to the Ural region and its impact on city planning and industry in Stalin's Soviet Union. The discussion also explores Mendeleev's influence on the built environment through his efforts in creating the most comprehensive map of Russia and introducing the metric system as head of the Bureau of Weight and Measures. In the summer of 1899 the Russian chemist Dmitrii Mendeleev travelled to the Urals region. Commissioned by the Ministry of Finance, his primary task was to investigate the natural wealth, conduct a new geological survey and trace the causes for the stagnation of the iron and coal industry in the region. He published his findings in the book “The Urals Iron Industry”. Upon his return to St Petersburg he wrote: “The Urals will provide Europe and Asia with huge quantities of iron and steel at a production cost which would be quiet inconceivable in Western Europe.” In his report he emphasizes a specific location in the southern tip of the Urals: the Magnetic Mountain and its rich iron ore. This mountain was constituted by a semicircular group of five low hills; they were a geological anomaly, consisting almost completely of iron. Thirty years after Mendeleev's report, Stalin founded Magnitogorsk in this location. The city which grew around the iron ore mine would become the largest producer steel and attract an international interest from architects, planners, engineers and economists.

Author: Elizabeth Yale

Title: What's Not in the Archives?

Abstract: Focusing in particular on seventeenth and eighteenth century Britain, my contribution to the roundtable seeks to understand the early modern archive by looking at its negative image, that is, the things naturalists (and, after their deaths, literary executors, collectors, archivists, and publishers) regularly did with documents instead of archiving them: throwing them away, ignoring them, publishing them, and circulating them. What was not archived, and why? What is missing from the archives? What was deliberately destroyed versus simply neglected? Exploring these questions allows to see how archives' originators understood the relationship between their archival activities and the study of nature. It also opens up the critical question of how heterogeneous early modern collections of papers, books, and objects become the early modern archives that we know today.

Author: Haiyan Yang

Title: Comparative Study on the Developments of the Contraceptive Pills in China and in the US

Abstract: This paper aims to compare the development of the contraceptive pills in China during the 1960s and the creation of the pills in the US in the 1950s. Towards the end of 1960s, Chinese research groups, especially that of Bilian Xiao in Shanghai, developed the low-dose contraceptive pills, which was first clinically used in the world. Xiao graduated with an MD from the Medical School of Saint John's University in 1949, an American missionary university in Shanghai. Xiao was also influenced by currents of 'Learning from the Soviet Union' and earned her PhD from the First Moscow State Medical University in 1959. This remarkably early development of low-dose pills reflects transnational features of Chinese biomedical science in the 1960s, in part through Xiao's exposure to both American and Soviet Russian influences, but also through certain local political, social and economic forces. This provides an opportunity for an informative comparison with the development of contraceptive pills in the US in the 1950s. A Chinese-American scientist, Min Chueh Chang, made an essential contribution to the US development. With a BSc from Tsinghua University and PhD from the University of Cambridge, he eventually joined the Worcester Foundation for Experimental Biology in Massachusetts in 1945 and had worked there until his death in 1991. In my opinion, the development of the pills in China was directed from top to bottom with the government's intention to plan the population growth; whereas in the US, the creation of the pills reflects different social and cultural motivations.

Author: Adrian Young

Title: Finding Voices on Pitcairn and Norfolk Islands: The Practice of Linguistic Fieldwork on Two "Natural Laboratories" in the Pacific

Abstract: Pitcairn and Norfolk are two small islands in the Southern Pacific, both inhabited by the descendants of 18th-century British mutineers from HMS Bounty and their Tahitian captives. During the last two centuries, the myth and romance surrounding the mutiny brought them to the attention of thousands of writers across the English speaking world, including a number of social scientists. They regarded both islands, largely isolated, with known histories and genealogies, and home to a unique culture born from the fusion of English and Tahitian elements, as perfect 'accidental social experiments.' During the twentieth century, the islanders' languages emerged as objects of interest to linguists in Australia and Britain. Administrators regarded 'Norfuk' as 'imbecilic' patios and campaigned to eradicate it, but social scientists identified both islands as a 'laboratory like cases' for the study of contact languages and creole dialects. This paper will follow the interest of outsiders in Pitcairn and Norfolk Island languages, from early glossaries compiled by travelers in the late-19th centuries to the advent of professional academic research on both islands in the 1950s by Alan SC Ross, AW Moverly, and Elwyn Flint. A focus on the practices of that fieldwork, especially the use of portable reel-to-reel recorders, will reveal the human and political entanglements that shaped linguistic research.

Author: Andrew Zangwill

Title: Density Functional Theory: How Mathematical Physics Launched a Revolution in Materials Physics and Quantum Chemistry

Abstract: Quantum mechanics dictates that the many-particle wave function Ψ is needed to calculate the physical properties of atoms, molecules, and solids. It is difficult to calculate Ψ when the number of electrons N is large because it depends on $3N$ variables (the Cartesian coordinates of all the electrons) and there is no easy way to account properly for the Coulomb

repulsion between every pair of electrons. In 1964-1965, the physicist Walter Kohn proved that knowledge of the electron density $\rho(x,y,z)$ was sufficient to calculate all the properties of an N-electron system. Using this fact, he proposed a computationally simple and self-consistent scheme to calculate ρ in terms of an exact (but unknown) functional of ρ . He then proposed an explicit form for this functional so (approximate) calculations could be done for real systems. By 1980, Kohn's density functional theory (DFT) had become the standard method used by solid state physicists to compute the properties of crystals. Chemists were more wary, but by 1990, they had found ways to implement Kohn's method with chemical accuracy for molecules. Today, DFT is by far the most popular method used by scientists interested to calculate the electronic properties of atoms, molecules, and solids. In this paper, I explain the origins of DFT in mathematical physics and discuss the revolution this theory has visited on quantum chemistry and materials physics.

Author: Qiong Zhang

Title: New Discourses on Qi as a Material Medium in Seventeenth Century China: The Case of the Fang School

Abstract: In the early seventeenth century, the Aristotelian theory of four elements was first introduced to China by the Jesuits, especially Matteo Ricci (1552-1610) and Alfonso Vagnoni (1566-1640). They designated these elements as yuanxing (literally, "elemental phase"), a term coined by Ricci to stress their more fundamental nature in comparison to their Chinese counterparts -- the five phases of metal, wood, water, fire, and earth. The Jesuits forged a linguistic and conceptual equivalence between air and Qi by defining Qi exclusively in terms of its materiality as a medium that fills the space between the elemental spheres of earth and fire. This paper explores what happened next after this novel Jesuit usage of Qi was circulated among Chinese scholars. It focuses on the Fang School formed around Fang Yizhi (1611-1671), his pupils You Yi and Jie Xuan, and his sons, who shared a common interest in Western learning, discussed and innovated on Jesuit ideas, and commented on each other's works. Among other subjects, they pioneered the investigations of Qi as a material medium for the transmission of sound, light, and physical impact. They also articulated new concepts such as kongqi and daqi, which have become the standard modern Chinese terms for air and atmosphere respectively. Thus the paper argues that this brief Aristotelian intervention constituted a significant event in seventeenth-century Chinese thought through instilling a new horizon of meaning, stimulating new lines of inquiries, and redirecting the trajectory of the Chinese notion of Qi in ways that eased its modern transformation.

Author: Rebecca Zorach

Title: "But Nonetheless Man Imagines Them To Be So": Athanasius Kircher and *Lapides figuratae* in Text and Image

Abstract: This paper addresses the hybrid nature of Athanasius Kircher's approach to the question of *lapides figuratae*, which we now recognize as comprising a variety of fossils, pseudofossils, and random mineral markings that were mistaken for images. Many of the images of such stones Kircher printed in his 1664 *Mundus Subterraneus* were adapted from Ulisse Aldrovandi's *Musaeum Metallicum* (composed 1570s, published in 1648), itself a compilation of multiple orders of knowledge about stones. While he is inspired by Aldrovandi's images, which he uses as evidence, Kircher takes a distinctive—more abstract and experimental—approach to the origins of figured stones. Although scholars have recently revised our understanding of Kircher's views on fossils, they have largely left aside the questions opened by the gaps between word and image in his text. This paper looks at the different kinds of knowledge Kircher attempted to combine and the ways in which text and images collide. There is a marked disjunction between Kircher's experimental thinking about the origins of such stones and the way the images present them as implicitly motivated by some intelligence or intention that could only be located in Nature. These images may be partly to "blame" for the bad repute into which Kircher's book fell, but they also suggest the attractiveness of the idea of Nature as an artist well beyond its heyday in the sixteenth century.