Session Abstracts for 2013 HSS Meeting

Sessions are sorted alphabetically by session title. Only organized sessions have a session abstract.

Title: 100 Years of ISIS - 100 Years of History of Greek Science

Abstract: However symbolic they may be, the years 1913-2013 correspond to a dramatic transformation in the approach to the history of ancient science, particularly Greek science. Whereas in the early 20th century, the Danish historian of sciences Johan Ludvig Heiberg (1854-1928) was publishing the second edition of Archimedes' works, in the early 21st century the study of Archimedes' contribution has been dramatically transformed thanks to the technological analysis of the famous palimpsest. This session will explore the historiography of Greek science broadly understood during the 20th century, including the impact of science and technology applied to ancient documents and texts. This session will be in the form of an open workshop starting with three short papers (each focusing on a segment of the period of time under consideration, Antiquity, Byzantium, Post-Byzantine period) aiming at generating a discussion. It is expected that the report of the discussion will lead to the publication of a paper surveying the historiography of Greek science during the 20th century.

Title: Acid Rain Acid Science Acid Debates

Abstract: The debate about the nature and effect of airborne acid rain became a formative environmental debate in the 1970s, particularly in North America and northern Europe. Based on the scientific, political, and social views of the observers, which rationality and whose knowledge one should trust in determining facts became an issue. The papers in this session discuss why scientists from different countries and socio-political backgrounds came to different conclusions about the extent of acidification. How did civil servants and politicians handle scientific controversy? Who benefited from scientific uncertainty? In discussing such questions, the panel seeks to illuminate the complexity of acid rain debates, showing that the issues at stake went far beyond saving the environment from pollution.

Title: Agricultural History of American Science

Abstract: Does science have an agricultural history? What would the history of science look like if it were told from the perspective of agriculture? This session explores the intersection between two distinct historical subfields—agricultural history and the history of science—by focusing on U.S. agriculture from the early nineteenth century to the late twentieth century. The production of food and fiber through agriculture has been extraordinarily significant as a shaping context for the production and circulation of knowledge, the development of scientific institutions and funding, and the construction of key ideas and concepts in the natural sciences. The session will emphasize larger historiographical arguments, using specific case studies from U.S. history as starting points for reflecting more broadly on the potential for reframing the history of American science from an agricultural perspective. We thus explore the possibility not only for an enhanced focus on the history of the agricultural sciences—the themselves arguably understudied given their enormous importance and widespread pursuit—but also more provocatively how the history of science might be re-envisioned as agricultural history. The related subfield of environmental history is a significant mediating influence for many of us, but while there has already been considerable discussion of the intersection of the history of science with environmental history, there has been less attention to agricultural history as a field, even though it, too, has its own organizations (e.g., Agricultural History Society) and offers promising opportunities for integrative scholarship between subfields. Presenters include both agricultural/environmental historians and historians of science.
Title: Applying Science in America during the Cold War: Regulation, Industrial Management, and Leisure

Abstract: The Cold War era was marked by an increased profile for science in American industry and public policy. But in many cases, the role of science in planning and development was complicated by the particular context in which it was deployed. The papers in this panel offer four instances where using applied science in the United States during the Cold War was complicated by regulatory concerns, changes in industrial management, and new uses of leisure time. James Bergman discusses the development of industrial agriculture and frozen foods had to be integrated with the perceived realities of annual climatic change and regional differentiation. Renée Blackburn considers how the development of new safety technologies by auto manufacturers in the 1960s had to negotiate the changing regulatory environment informed by regulatory science in that period. Peter Neushul’s paper discusses World War II-era science, wave pools, and surfing. And James D. Skee looks at the case of the Disney organization, to show how operations research and other consultants at times molded their work to support the needs of executive decision makers. In each of these cases, scientists sought to prove the worth of their discipline; but disciplines had to change in order to accommodate the shifting contexts in which they were deployed.

Title: Behavioral Sciences in the Postwar Era: Community of Discourse or Community of Practice?

Abstract: With roots in the massive World War II mobilization of social scientists, a distinctive, cross-disciplinary “behavioral sciences” community emerged in early Cold War America. Self-labeled “behavioral scientists” of the postwar years shared some traits with earlier periods of avowed scientism in U.S. social science— notably the 1920s. But the postwar “behavioral sciences” community was distinct from earlier efforts to promote a nomothetic science of man. Shared wartime service yielded landmark studies, methodological innovations, and enduring networks that, together, suggested that Minerva’s owl was set to take flight. Postwar behavioral scientists were distinguished, too, by their ambitious theorizing and formal modeling, often in a mathematical key. The embrace of mathematics extended to empirical research design and rigorous graduate training. The elite and well-connected social scientists promoting the behavioral sciences argued for—and often carried out—team-based interdisciplinary projects organized around real-world problems. Some of these same figures acted as brokers in an unprecedented patronage system centered on foundations and military sources. By the early 1950s the behavioral sciences movement was in full swing—a peculiar mixture of cocksure scientism, methodological rigor, and Cold War government service. Though its institutional and patronage profile began to shift by the early 1960s, the behavioral sciences’ intellectual agenda—notably the focus on formal modeling and systematic theory—remained broadly influential within American social science for decades.

Title: Beyond Blood and Guts: Probing the Body for Knowledge in the History of Medicine

Abstract: How have medical experts positioned themselves as arbiters of truth by examining structures of the body for hidden meaning? This panel explores historical cases in which the medicalized body was configured as an esoteric text, the specialized knowledge contained therein legible only to the discerning physician or scientist. The body’s structures, qualities, morphological configuration, and physiology could all be mined for useful information about the health, temperament, criminal tendencies, racial identity, and other intimate characteristics of the individual. The proficiency of physicians and scientists in reading the body thus allowed them to assert and negotiate the role of the expert. Miriam Rich analyzes how an early nineteenth-century obstetrician claimed a therapeutic mandate through his reading of the uterus as a locus of racial difference; Courtney Thompson examines the development of phrenological theories and claims to expertise around the body of the criminal in prisons and court rooms in the early nineteenth century; Lisa Haushofer explores how the bodies of patients and animals were understood to articulate the anatomical, physiological and surgical “removability” of the spleen in the 19th century German states; Eli Anders considers how notions of bodily individuality inflected late-nineteenth century debates about the efficacy of bloodletting; and David Jones looks at surgeons’ debates about the nature of coronary artery
disease in the mid-twentieth century. Together, these case studies illustrate how knowledge read from the body was broadly deployed in therapeutic, legal, and medical settings.

**Title:** Biology on Land, at Sea, and in the Air: Research Methods, Transportation Technology, and the Biological Sciences in the United States, 1930-1975

**Abstract:** The increasing sophistication and changing nature of biological research in the United States during the period between 1930 and 1975 was impacted by many factors, not the least being the increasing growth of government agencies such as the USDA, NRC-NAS, CAA, and the various arms of the Smithsonian Institution, that facilitated various research projects in the biological and environmental sciences. In addition to institutional support and monies, the availability of new transportation systems such as aircraft, and seemingly less glamorous systems such as canals, allowed biologists, ecologists, plant pathologists, microbiologists, chemists, and environmental scientists, to create new research practices and collection methods, establish new environmental and toxicity standards, and examine emergent categories of ecosystem risk. This panel will explore how academic and governmental scientists successfully leveraged various institutional and technological systems to access ecosystems on the land, in the skies, and within the sea, and in time began to change the way these research spaces were studied as the spaces themselves evolved or were altered through drastic human manipulation. The increasing sophistication of civilian and military aircraft, beginning during the 1930s, and continuing into the Cold War gave biologists access to newly discovered airborne ecosystems. In addition aircraft facilitated new systems for pesticide use, and more importantly, the implementation of means to study and hopefully contain the hazards created by this new airborne delivery system. Finally, the Panama Canal, would itself become the subject of study for ecologists as the link between oceans created new ecological risks for marine biodiversity.

**Title:** Boxed Environments – Glassware and the Rise of Ecological Thinking

**Abstract:** The session discusses the role of glassware – be it test tubes and pipettes in the laboratory, aquaria in zoological stations, or glass animals and flowers used as teaching resources for universities – in the formation of ecological knowledge from the late 19th to the middle of the 20th century. Almost impermeable and yet almost invisible, strong and fragile at the same time, glassware possesses the quality of both confirming and dissolving boundaries between research objects and their environment and inspired scientists to reflect on the specific qualities of „environment“ in general. The papers discuss aspects of this specific epistemic productivity of glassy objects with regards to their role in environmental history. While Florian Huber describes that the glass models of marine invertebrates fabricated by Leopold and Rudolph Blaschka were so fascinating to scientists and private collectors just because they seemed to have absorbed the real ocean, resembling its equally fragile and ephemeral creatures and thus inspired the generation of new knowledge about marine environments, Christina Wessely explores the role of glassware in „boxing practices“ in the laboratory and the field around 1900 and shows how they contributed to shape the notions of environment, milieu and ecosystem. Arguing that in the context of cybernetics ecological thinking underwent a significant transformation, Jan Mueggenburg will present John Lilly's dolphin experiments during the 1950s and 1960s as the paradoxical attempt to reopen the „boxed environments“ of tanks and aquariums without loosing the benefits of control and isolation, which are fundamental to neobehaviorist research.

**Title:** Caste and its (Dis)contents: Caste and the Scientific Imagination in India

**Abstract:** Caste has been a significant and critical factor in the history, culture and social organization in India. Social and the feminist studies of science have long argued that we need to understand science within its social and political locations. In this panel we examine how the centrality of caste has shaped the Indian science and technological imagination. Exploring three diverse sites – Anthropology, Ecology and Technology - we elaborate specific ways in which caste ideologies mediated the production of scientific knowledge, educational policies, and technical training programs that, in turn, served to further reinforce and validate caste stratification.
**Title:** Catholic Engagements with Science in the Nineteenth Century

**Abstract:** Scholars and popular observers alike recognize the dramatic encounters that have marked the history of Catholics and modern science: the Galileo Affair, the contested contributions of early modern Jesuit practitioners, the establishment of the Pontifical Academy of Sciences, the challenge to family theology made by the availability of artificial contraception. But as Don O’Leary and others have recently pointed out, such dramatic history is ultimately superficial. We need detailed empirical studies carried out in national contexts globally to uncover the variety of Catholic opinion regarding science and to begin to answer how, when, and to what extent Catholics cleaved to scientific learning. These three papers speak to this developing research agenda. Addressing an array of pertinent topics in nineteenth-century America, Italy, and Germany, they demonstrate the interplay of Catholic theologies, authorities, and institutions, on the one hand, with scientific theories, professional elites, and discoveries on the other. Their authors hail from diverse institutions and represent a balance of professional ranks. The session’s chair and commentator is an emeritus professor in the Graduate Program in History and Philosophy of Science at Notre Dame, who has served on the governing council of the History of Science Society and advised both the American Catholic bishops and the Vatican on issues in contemporary science. The topics that we will be addressing cohere in a common theme and speak pointedly to the complicated history of Catholics and modern science. We hope to make helpful suggestions about how the study of this history can be enlarged.

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**Title:** Changing Meanings in/of the Middle East: Archaeological Work and the Disciplined Past

**Abstract:** This panel is an attempt to bring together recent work on the history of archaeological practices both in and relating to the Middle East (broadly considered). It examines how practices and representations related to the formation and institutionalisation of the archaeological discipline across the nineteenth and twentieth centuries have constructed changing meanings of the region, whether internally or externally. It also interrogates how the circulation of knowledge as a material practice has been particularly important in this regard. By examining the history of archaeological work in these terms, this panel aims to make a wider point. The papers not only illustrate how archaeological knowledge practices took place within discrete national and regional contexts. Rather, they illustrate that these practices both constructed and then crossed national and regional boundaries, too. Archaeological work was intertwined with local, national and transnational networks. Indeed, whether in material, visual, or any other form, it was almost permanently knowledge in transit. Therefore, the history of this work emphasises the necessity, previously suggested by scholars such as Jim Secord and Marwa Elshakry, of asking new questions about the ways in which scientific knowledge is made and circulated. How (or not) does knowledge cross (national, regional) boundaries, and why? How is knowledge originally generated in the metropole received and translated with reference to local genealogies of enquiry, and vice versa? What new lines of enquiry can placing the construction of scientific knowledge in a cross-cultural context generate? This panel provides an effective way of answering these questions.

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**Title:** Chemists and Chemistry in the Nineteenth Century: A Session in Honor of Alan J. Rocke

**Abstract:** For the last 35 years, in six books and nearly fifty articles, the work of Alan Rocke has set the standard for understanding and recapturing the lost world of nineteenth century chemical thought. His detailed contextualized biographies of Hermann Kolbe (1993) and Adolphe Wurtz (2000) have revealed the nuances of conceptual and institutional history of chemistry in Germany and France. His latest major book, Image and Reality (2010), is the most extensive modern study of August Kekulé, and a groundbreaking work in understanding how nineteenth century chemists used vivid mental images and visual tools to “see” the microworld of the atom and molecule. Rocke’s work has ranged across the spectrum of nineteenth century chemistry, and includes the development of chemical and physical atomism, the emergence of the structural theory of organic chemistry, as well as the pedagogical, institutional, and social context of chemistry in nineteenth century Germany and France. Working across three languages and three countries, Rocke has repeatedly led the way in creating a fully contextualized account of the development of atomism and organic chemistry in the nineteenth century. This session will celebrate
Title: Chymistry and Life in Early Modern Europe

Abstract: Over the past two decades historians have benefited from increasingly sophisticated and wide-ranging studies of early modern alchemy and chemistry or ‘chymistry.’ This session aims to examine the interrelation of chymistry and life in early modern Europe, offering a rough narrative of the development of this interrelation in the works of major chymists from the later-sixteenth into the early-eighteenth centuries. Hirai concentrates on recovering the valences and core of late-Renaissance medical humanist and chymist principia vitae or ‘principles of life.’ His study provides a useful background for Klein’s reconstruction of Daniel Sennert’s search for a chymical panacea, something Sennert developed through laboratory experiment and critical correspondence. Ragland contrasts chymical approaches to the body and health with more reductive mechanistic ideals, as found in the work of Franciscus Dele Boë Sylvius, a leading teaching chymist and physician at Leiden University in the mid-seventeenth century. Finally, Chang examines Stahl’s under-researched early works to recover the context and development of Georg Ernst Stahl’s chymical vitalism. Each paper approaches the polyvalent intersection of chymistry and life with different objects of study—from intellectual principles of life to laboratory-tested chymical cures, the theory and practice of chymical versus reductively mechanistic medicine, and Stahlian vitalism as developed in context. But there are striking connections: the Renaissance medical humanists supplied Sennert with important models for his ensouled chymical atoms, Sennert’s own medicine was an inspiration for Sylvius’s qualitative, corpuscular, experimental chymistry, and Stahl’s vitalism grew in part within later developments of Sylvian medical chymistry.

Title: Correspondence in Modern Science

Abstract: Although much excellent scholarly work has been done on scientific correspondence in the Scientific Revolution and Enlightenment, less scholarly attention has been devoted to the role of correspondence in modern science. The papers in this panel will explore correspondence in a variety of scientific settings in the nineteenth and twentieth centuries. Tina Gianquitto’s (Colorado School of Mines) paper draws on the rich correspondence between women plant collectors and botanists at Harvard University, and uses their letters to consider what it meant to be a “citizen” of the scientific community in the late nineteenth century. Melinda Baldwin (American Academy of Arts & Sciences) examines the correspondence between George Gabriel Stokes and John Tyndall and explores the connections between Stokes’s personal letters and his work on the Philosophical Transactions of the Royal Society. Barbara Becker (UC-Irvine) uses correspondence to re-evaluate William Huggins’s “The New Astronomy,” an influential account of the origins of astrophysics. Finally, Diana Kormos-Buchwald (California Institute of Technology), the general editor and Director of the Einstein Papers Project, will discuss Albert Einstein’s correspondence and the insights it provides into Einstein’s professional and personal life. Bernard Lightman (York University), director of the John Tyndall Correspondence Project, will offer a synthetic commentary; Janet Browne (Harvard University), Senior Research Editor (USA) of the Darwin Correspondence Project, will act as chair.

Title: Creative Relationships: Gender and the Practice of Science on Four Continents

Abstract: This panel examines the ways in which different kinds of collaborative partnerships and global correspondence networks influenced the careers of women scientists living and working in very different countries. Building on recent scholarship in gender and the history of the life sciences, this panel challenges the traditional geographical center of this field by broadening the discussion to include the experiences of women naturalists in the United States, Japan, England, and Brazil. Women practicing natural history negotiated social, cultural, and institutional boundaries in constructing their professional careers. For many women, entering into a creative collaborative research partnership with spouses or family members enabled them to pursue advanced research in the natural sciences, a field that was historically occupied by women. Others benefited from the development of
international networks of women naturalists, the support of local and international women’s groups, garden clubs, and scientific societies, and lifelong personal and professional relationships with naturalists working in their fields of research. Presenting cases of different women in several countries, we intend to reflect on the variety of contexts women experienced in pursuit of their scientific research and the establishment of their professional lives. Through these comparisons, we aim to better understand the range of historically specific strategies and conditions – from collaborative family relationships, to membership in local and international scientific societies, to opportunistic employment in scientific institutions -- that were necessary for these women to enter into scientific circles.

Title: Crossing Boundaries: Vernacular Science in the Late Medieval and Early Modern Worlds

Abstract: As scholars such as Pamela O. Long have productively pointed out, the fifteenth and sixteenth centuries saw a revolution in understanding as traditional interpretations of the world were both transmitted to and influenced by non-academic audiences. We propose a session on late medieval and early modern studies of the natural world that crosses boundaries both between between periods and contexts, re-examining the formalization of traditional knowledge and its incorporation into academic contexts; the influence of the academic production of knowledge in non-academic contexts; and the interaction between scholarly and artisanal knowledge.

Title: Demonstrating Darwin: Introduction to a new pedagogical approach in the history of science

Abstract: This proposal is for a pedagogical workshop that introduces an innovative and interactive way to engage students with the history of science: Reacting to the Past (RTTP). Developed by a group of teachers at Barnard College, NY, RTTP consists of elaborate "games" set in the past, in which all learners are assigned roles informed by classic texts in the history of ideas. One RTTP game that is particularly appropriate for historians of science is Charles Darwin, the Copley Medal, and the Rise of Naturalism, 1862-1864, which thrusts students into the intellectual ferment of Victorian England just after publication of The Origin of Species. Students take on roles of different members of the Royal Society to debate and eventually decide whether or not Darwin merits the Copley Medal, the Society's most prestigious honor. What makes this episode particularly apt for enabling students to grapple with history is that Darwin was nominated more than once, and thus, there is no “correct” or prescribed outcome. By playing the game and coming to their own decisions, students get a realistic idea of how the debate could have gone either way in any given year. This workshop will provide HSS members some hands-on experience with the RTTP pedagogy by having them play one session of the Darwin game. Teacher and scholars who designed or have used this game in their classes will be at the meeting to introduce the concept, guide participants through the session, and also share their own experiences with Reacting.

Title: Developmentalism and the Human Sciences in Nineteenth-Century Britain

Abstract: Broadly conceived, this panel explores the intersection of the human and natural sciences by examining theories of developmentalism throughout nineteenth-century Britain. By focussing on “developmental” theories of the human sciences, particularly in the realms of ethnology, historical writing, and social evolutionism, the panel gives further credence to Peter Bowler’s general thesis about the centrality of non-Darwinian models of nineteenth-century developmentalism. For instance, early nineteenth-century ethnologists developed theories of human development and classification that stressed an orderly and goal-directed view of historical and cultural change that would share little with the contingent and nonteleological view of evolution that is associated with the Darwinian revolution. Such developmental theories eventually competed directly with natural selection, informing the work of, for instance, writers of the evolutionary epic who were inclined to a directional, progressive, and purposeful view of natural and human history. Variants of Lamarckian evolution also remained central throughout the century, so much so that even Herbert Spencer, in the 1890s, was defending “use inheritance” in order to preserve both progress and purpose in his broader scheme of human development. From ethnology and early nineteenth-century travel narratives to the mid-century evolutionary epic on to late century debates within biology, this panel promises to shed light on little explored themes within the human sciences by examining the way in which a diversity of social
theorists, natural historians, and men of science sought to classify and historicize “man” throughout the nineteenth
century.

Title: DNA at 60: New Sources, New Questions, New Interpretations

Abstract: Since 2003 when “DNA at 50” (i.e. the 50th anniversary of the discovery of DNA structure, widely
viewed as a turning point in the history of 20th Century bioscience) was marked by numerous events world wide,
including a dual HSS session, a variety of new sources, both primary and secondary, opened up. This session
examines the impact of such new sources in enabling historians of science to pose new questions and reach new
conclusions. The 1st speaker, Pnina G. Abir-Am interrogates the doubling of the number of discoverers half a
century after the event, when the scientific community declared four DNA protagonists as discoverers. Arguing that
neither 4 nor 2 are numbers that agree with the recent historical evidence, Abir-Am further inquires whether the
designation of Crick and Watson as sole discoverers in 1953 reflected efforts to gain credit for that discovery by a
lab which had no DNA program. The 2nd speaker, Miguel Garcia-Sancho draws attention to Fred Sanger, a twice
Nobel Laureate for the sequencing of both proteins and DNA, and the impact of his sequencing efforts on the
discovery of DNA structure and its reception. The 3rd speaker, William C. Summers, reexamines the reception of
the discovery of DNA structure by the US based Phage Group, questioning the received notion that the discovery
was immediately accepted. The 4th speaker, Yves Gingras, reexamines the reception of the back-to-back DNA
papers of April 1953, and their emergence as objects for historians, by means of citation and co-citation analysis.

Title: Epistemic Strategies in 20th Century Physics and Cosmology: Reshaping Spaces,
Structures and Styles

Abstract: This panel explores several themes central to the history of physics and cosmology, examining
transformations of ‘systems of world’ resultant from epistemic strategies. Historians of science and technoscience
have recently turned their attention to the electronic computer. This panel develops on the current focus, examining
the electronic computer as an epistemic entity, from a historical epistemological context. Building on this
momentum the session extends the area of enquiry to examine remarkably deficient subject material, string theories
and post war cosmologies, with novel contributions to the history of science literature. The topics of this panel’s
papers span the role of the Cosmic Microwave Background in re-shaping the conceptual space of modern
cosmology, the transformed role of duality relationships in the second superstring revolution, and the early use of
the electronic computer changed perceptions of numerical methods and led to the introduction of the numerical
experiment. Converging on the theme of transformative epistemic practices each of these papers proposes new
insight into reshaped spaces, structures, and styles.

Title: Euro-Asian Encounters in the Scientific Revolution: Visual and Material Culture on the
Move

Abstract: In recent years, the history of scientific revolution has increasingly been interpreted as a global
phenomenon, with modern science emerging from the increasing interaction between English mechanics, Dutch
naturalists, Muslim ulamas, Hindu physicians, or African agriculturalists in the Age of Discoveries. As historians
from Kapil Raj through Warwick Anderson to John Krige have argued, scientific knowledge emerges in contact
zones where different cultures meet and negotiate with each other. Our panel contributes to this discussion by
focusing on the interaction between European and Asian knowledge systems in the early modern period. We
examine contacts between England, the Netherlands and the Holy Roman Empire, on the one hand, and the Ottoman
Empire, the Kandyan kingdom of Sri Lanka, and the sultanates of the Indonesian archipelago, on the other. Offering
a symmetrical treatment, we examine how European natural history and medicine developed through contact with
Asia, and how Asian knowledge systems evolved through their interactions with European natural philosophy. The
four papers reveal the rich and complex procedures of negotiation that emerge in intercultural contact zones, and
carefully analyze the translation strategies that Europeans and Asians employed to make sense of new and foreign
systems of knowledge. The panel brings together speakers from diverse backgrounds and career stages: a PhD candidate in history and organizational behavior, a postdoctoral scholar in the history of medicine, a junior scholar in the history of science, and a senior museum curator from the history of art.

**Title:** Evidence and Evolutionary Theory at Darwin’s Deathbed: Rethinking the “Eclipse of Darwin”

**Abstract:** For several decades after Charles Darwin’s death in 1882, evolutionists and anti-evolutionists claimed that Darwinian natural selection had died along with him. These over-reaching proclamations indicated a conceptual biological debate regarding the evidence used to support evolutionary theories. Many evolutionists believed that natural selection was an insufficient explanation for the creation of new species. Numerous other evolutionary theories emerged to fill the void left by Darwinian natural selection. Two central issues emerged from this milieu: what constituted evidence of a particular evolutionary theory and how would naturalists reconcile evolutionary theory with heredity models. As a further complication, evolutionary theory spread throughout many countries and met a variety of critiques from naturalists from each nation it encountered. This panel examines the complex relationship between evidence, theory, and internationality that shaped the pre-synthesis discussions. Our papers provide nuanced perspectives, descriptions, and discussion of the changing evidence needed to prove biological theories that characterized the so-called “eclipse of Darwinism” from 1880 to 1940.

**Title:** The Fifty-Year Anniversary of the Limited Test Ban Treaty: Origins and Legacies

**Abstract:** October 10 marks the fifty year anniversary of the Limited Test Ban Treaty. The 1963 LTBT agreement between the US, USSR, and UK ended nuclear testing above ground, in the oceans, and in outer space. Although chiefly remembered as a milestone in nuclear arms control, the LTBT also proved the first international environmental treaty. Such linkages were by no means coincidental. As Joseph Masco has recently argued, the LTBT structurally connected national security imperatives (testing) with growing concern about the health of the global environment (fallout). Thus, while the LTBT "ensured 30 more years of the nuclear arms race," as Masco notes, it also "demonstrated that industrial processes could damage the global biosphere ... and that international agreements could be forged to limit future damage." The four papers featured in this session build on Masco's insights by further considering the tight coupling of science, diplomacy, and environmental concern that led to and arose out of this landmark treaty. Accordingly, the first two papers on the panel explore many of the major events and issues leading up to the LTBT by investigating the relationship between international scientific bodies and fallout risk assessment (Higuchi) and concerns over the growing explosive yields of thermonuclear weapons testing (Wellerstein). By exploring the connections between radioactive tracers and global environmental knowledge and consciousness (Jessee) and the influence of the LTBT on the Stockholm Conference in 1972 (Eardley-Pryor), the final two papers establish links between atmospheric nuclear testing and later scientific, international, and environmentalist developments.

**Title:** Foundations at the Philosophical Turning-Points: Chronicling Conceptual Turns in the Theories of Modern Physics

**Abstract:** Recent times have seen a renewal of interest in foundational questions in physics, beginning from growing interest in quantum information theory. The interest has also come about from the direction that experiments and scientific applications have been moving towards, which necessitated in the recuperation and re-positioning of not-quite resolved conceptual and theoretical questions in relativity and quantum theory, and physics subfields that grew subsequent to them. At the same time, new research has brought to the re-querying of old assumptions and factual arguments, bringing about greater insight while adding new interpretations and facts to existing historical corpus. Often, it takes being present in the future to be able to go back to the past to reconstitute its narrative more completely. This session comprise of presentations that explore conceptual developments and re-clarification of new physics diagrams from foundational explorations into relativity and quantum theory to their
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more evolved representation in condensed matter and particle physics. Each of these presentations contain research that attempt to revisit known ideas and epistemologies from fresh perspectives, while also introducing and interrogating emergent perspectives that are not always part of the mainstream conversation. Since each of the presentations are concerned with delineating philosophical interventions in the scientific figures and objects of their inquiry, and positioning these interventions within a sociological and cultural frameworks involving a multiplicity of human and non-human actants.

Title: Happiness Beyond the Professoriate - Advising and Embracing Careers Beyond the Academy

Abstract: According to AHA president Tony Grafton, the number of academic jobs available to historians in 2009-10 was roughly half the number of PhDs conferred that year. In recent years, much has been written about Plan B, and it is clear that the trend of a contracting job market and too many qualified PhDs is neither new nor likely to disappear. And professional organizations and societies, HSS among them, are beginning to openly grapple with this long-standing issue, and with how best to serve their non-tenured members; graduate students seeking jobs outside the academy; and those faculty members who are attempting to advise them, sometimes in areas in which they themselves have little experience. This panel will address these issues that affect us all. Speakers will include David Attis (Practice Manager, Education Advisory Board), Sara Schechner (Curator of Historical Scientific Instruments, Harvard University and Professor of Museum Studies), Jim Grossman (Executive Director, American Historical Association), and HSS president Lynn Nyhart (Professor of the History of Science, University of Wisconsin, Madison). They will discuss how career paths can be successfully pursued in policy and corporate worlds, museums, and as independent scholars, as well as the interests and challenges of academics who are advising students considering a broad range of jobs. We hope that all HSS members will consider attending this session, as careers and colleagues outside the academy are important to the entire community.

Title: Historians and Biologists: Mutualism, Commensalism, or Parasitism?

Abstract: History is emerging as an important and desired perspective within modern biological research programs. The four historians in this session will discuss their collaborative work with biologists in the fields of evolutionary biology, ecology, and conservation biology, discussing some of the benefits and drawbacks of such interdisciplinary work. The goal of the session will be to inspire a group discussion about the significance of historical perspectives for modern biological research and vice versa, while also exploring potential drawbacks of such collaboration. David Foster, an ecologist and lead Principal Investigator of the Harvard Forest Long-Term Ecological Research site, will chair the session and provide a brief introduction to the session, its goals, and each speaker and paper. After the papers, he will provide a commentary on what he, as a working ecologist, sees as the potential benefits and pitfalls of biologists collaborating with historians. Hopefully the conversation can expand to include a broader discussion of other ways historians of science can collaborate with scientists to deepen both our historical understandings and scientific research. This session will also include a discussion of possible funding mechanisms for such collaborative research.

Title: Historical Ontologies

Abstract: Epistemology is traditionally distinguished from ontology. Whereas the former asks how we can know things about the world, the latter purports to address the nature of things in themselves. Drawing on recent work by historians, anthropologists, and sociologists of science and technology, this panel seeks to complicate that distinction by showing some of the ways in which knowledge of the world and its constitution are historically and mutually entwined. The papers in this panel draw on case studies from the history of geographical surveying, fossil dinosaur assembly, computational mathematics, and syntactical linguistics. Together, they seek to illuminate various processes of "objectification" by which new kinds of objects are made and made possible in a range of material and social contexts. The panel aims to contribute to ongoing conversations about representation and intervention in
scientific practice, dichotomies between nature and culture, and the mediating role of technology in knowledge production. To illuminate how various processes of "objectification" function in different scientific disciplines, we will recover the historical conditions of possibility that gave shape to diverse objects of knowledge - including spatial directionality, fossil dinosaurs, logical theorems, and the language organ - emphasizing the complex matrix of formalism, experience, language, interpretation, and technology that (in)form our world.

Title: Histories of Data in Biology and Biomedicine

Abstract: The collection, storage, management and analysis of large quantities of data play an increasingly important role in the natural and social sciences, as well as in business, public policy, and health care. Historians of science have shown a recent interest in contributing to the understanding of the methodological, epistemological, social, and political implications of science that is driven by ‘Big Data.’ This panel aims to extend and deepen those discussions by situating data practices in a variety of disciplinary and historical contexts in the biological and biomedical sciences. By examining the use of data at four distinct sites – within genomics, postcolonial biomedicine, paleobiology, and ecology – these papers locate specific historical, social, material, and political contexts from which many of our current fascinations with data emerged. Doing so will allow us to critically examine the emerging cultural role of Big Data and ‘data-driven’ science, and to problematize the existing narratives that purport to explain the prominence of data in modern life. The questions raised by these papers include: How and to what extent is data tied to specific technological infrastructures (particularly digital electronic computers)? What is the relationship between data and modeling? What role do visualizations play in constructing and enabling the use of data? Does size matter—what is distinctive about ‘Big’ data? What social and political reconfigurations are made possible by and through data-oriented science? And, to what extent are the practices associated with data new?

Title: The History of Science and/as the History of Media

Abstract: Recently, the history of science and knowledge has taken center stage in media theory and study. Perhaps prompted by the emergence of digital mediums and information economies, media technologies have come to be viewed as not merely static objects but as part of broader ecologies of epistemology, power, and technique. This panel takes up this recent trend to inquire how media genealogy and history of science might reciprocally transform the study of both. These papers collectively seek to rethink not only media, but the very nature of history and how it is told by examining the traffic between the realms of scientific documentation, practice, and authority and the spaces of visualization, spectacle, and communication. Traversing histories of physics, cinema, oceanography, social science, and architecture and design, these papers collectively work to rethink how knowledge is a medium, and how media transform what we know, what and how we sense, and how we act in the contemporary world.

Title: Human Sciences as Field Sciences

Abstract: This session explores how twentieth century research in the human sciences breached the bounds of the laboratory and moved into the field. Focusing specifically on work in the United States, these papers engage with a broader body of literature on the laboratory-field border and document its permeability in the realm of twentieth century research in industrial psychology, space medicine, and social relations. In each case, fieldwork was at once a rejection of the laboratory’s restrictions and an extension of the laboratory ideal. Blatter outlines how industrial interests recruited Harvard psychologist Hugo Münsterberg and his student Harold Burtt to experimentally assess lighting conditions, both on the street and in the lab. In Bimm’s paper, Cold War era experiments on military men in extreme natural environments that were designed to improve the minds and bodies of astronauts are revealed to have had racial and colonial roots. Young describes how children’s summer camps came to be a key locale for World War II era research on social relations that had as their larger aim the facilitation of world peace. Bridging historical work on human subjects in psychology and medicine, this panel is a move toward more fully documenting fieldwork in the human sciences and its relation to the laboratory.
Title: Infection as Host-Parasite Interaction: Studying Parasites at the Interface of Biology and Medicine

Abstract: A parasite’s identity is far from fixed. To a medical doctor, it may represent the risk of infection and disease, while a biologist may see it as an ecological agent, just one among many interacting organisms. These identities embody two distinctly different conceptions of host-parasite interaction, which each call upon different methods and techniques: one stereotypically medical, the other biological. However, these identities are not mutually exclusive and have changed over time. In fact, historians have long argued that disease ecology is one particularly fruitful interface between biology and medicine. Epidemiology, broadly understood, is also an important conceptual space where host-parasite interactions were studied from a biomedical point of view. The papers in this session explore points in the 19th and 20th centuries where biological and ecological concepts of parasites, hosts, and their interactions have intersected with medical concepts of parasitic infection.

Title: Insides/Outsides: Drawing Out the Boundaries of Botanical Bodies and Environments

Abstract: In the eighteenth and nineteenth centuries, Europe witnessed a growing concern over the relationship between bodies and their proximate environments. In philosophy, science, and the arts, scholars explored whether specific climates determine or incline behavior, how local airs, waters and places contribute to health and disease, and whether sensitivity to environmental conditions produces an analogous sensitivity to a moral order. Underlying these widespread concerns are diverse and particular configurations of the relationship between bodies and environments. Where does the body end and environment begin? What boundaries distinguish an organism from its surrounding environments or define the internal systems that sustain life within it? What connections exist between bodies and environment, and are those connections to be embraced or resisted? These concerns have often been explored as particularly human concerns; however, plants in this period were understood to be particularly (even peculiarly) sensitive bodies. This panel would place plants at the center of a discussion of interiority and exteriority of bodies by addressing fundamental questions about the relationship between vegetable and other bodies and their surrounding environments. We would explore three instances in which botanical bodies in figures, experiments, and analogies help to define and/or subvert the boundaries between insides and outsides of the body and the boundaries between human bodies and other kinds. We will try to uncover how botanical bodies serve as a means of linking humans to a shared susceptibility to environment and yet leave room for humans to be free from its potentially devastating consequences.

Title: Institutionalizing Ethics

Abstract: The changing place and status of ethics in science, medicine, and engineering during the second half of the twentieth century played a significant role in the development of biomedical research and engineering in the U.S., but ethics is often not a focus in the history of science scholarship. This session centers on the institutionalization of ethics during the post World War II era and explores how the explicit and implicit incorporation of ethics into the realm of science and engineering shaped a new modern role for the scientist and engineer. By focusing on a variety of efforts to institutionalize ethics, the papers in our session draw attention to the social and political interactions that helped to form biomedical and engineering research and also examine how ethics altered professional responsibilities.

Title: Interrogating the Cosmos with Mathematical Imaginings and Physical Intuitions, 1880-1965: Bridging Disciplinary and Cultural Practices

Abstract: What defines a discipline and how did cosmology become one? The emergence of physical cosmology at the turn-of-the-20th century and the subsequent development of relativistic cosmology were predicated on bridging
the techniques and cultures of multiple fields with diverse tools and goals (mathematical, observational, and philosophical). These papers explore a range of implications of inter-disciplinary experiences of astronomers both before the creation of the theory of general relativity and in the midst of its transformations within GR physics and relativistic cosmology in the following decades. Scholars have taken for granted identities such as “cosmologist,” yet few of our actors began their careers as “cosmologists” or “relativists,” instead originating in observational astronomy, mathematics, celestial mechanics, cosmogony, engineering, nuclear physics, or physical chemistry. Nor did they necessarily align themselves with such a disciplinary identity. However, our papers show that a shared culture of practices, questions, intuitions, working models, and standards came to forge modern physical cosmology across these years. Several papers also examine the philosophical impetus of their actors’ work, such as epistemological limits of measurement or a metaphysics of “empty space.” By focusing this session on the aims and practices of scientists, some of whom bridged pre-relativistic and relativistic cosmology, and all of whom crossed and re-aligned the boundaries between observational astronomy, mathematics, and theoretical physics, we hope to contribute to a fruitful dialogue regarding the diverse meanings of “cosmology,” “space,” and even “geometry” for practitioners in the first half of the 20th century.

Title: Invisible Lives: Industrial Microbiology and Fermentation Sciences in Global Perspective

Abstract: Since the identification of yeasts, bacteria, and other microbes as living organisms in the mid-19th century, various industries have incorporated new knowledge and techniques into their production processes. Focusing on key fermentation-based industries in Japan, Germany, and the United States in the first half of the 20th century, this session will explore how these industries adopted new microbiological processes and, in some cases, found new uses for microbes to substitute for traditional methods. Such technological transitions often involved negotiations between traditional craft skills and laboratory-based scientific techniques, and were highly dependent on the specific political, social, and scientific contexts in which the industries operated.

Title: The Isis Bibliography and the Profession: Past, Present, and Future

Abstract: This session deals with the Isis Bibliography, which was an integral part of George Sarton’s vision of Isis at its inception in 1913. The Isis CB has continued without any appreciable gaps for a century. The papers in this session deal with the past, present, and future of the bibliography. They demonstrate how a simple accumulation of citations can give us new insights into our field. Organized by the current editor of the Isis Bibliography, it features papers by scholars at all levels of the profession. The past editor will speak about the bibliography under his leadership. A senior undergraduate who is taking his degree this spring will explain how the bibliography reveals new insights into the history of our discipline, especially how the subject matter has changed over the past century. A graduate student who helped design and analyze a recent survey about the use of the Isis Bibliography will discuss the results of that survey. And a senior scholar will discuss his view of the future of bibliographical research in the age of the Internet.

Title: Laying the Foundation for your Digital or Computational Project in the History of Science: an Interactive Workshop

Abstract: Rapid advances in computer technology have created exciting new opportunities to enhance and transform historical research and education. Many historical projects involve the use of digital materials, and diverse digital collections are becoming increasingly available in open-access repositories. One of the big promises of the “digital turn” in scholarship is increased opportunity for a sharing and integrating datasets. But how can we turn those aspirations of openness and interoperability into realities? And once we do, how can we leverage computational tools to gain new insights into the history of science?

Participants in the international Digital History and Philosophy of Science Consortium (www.digitalhps.org) are actively developing and implementing a wide range of tools and techniques, ranging from repositories and data management solutions to text-mining, network analysis, and ontologies. Come learn about how you can use these
tools to jump-start or enhance your own digital projects! You will see brief demonstrations by representatives from various Consortium projects, and have an opportunity to interact directly with those representatives to learn more about how you can use those tools in their own work.

If you are already using or developing digital and computational methods, we want to hear from you as well! Come learn how to get involved with the Consortium, and exchange ideas and insights from your own research. This workshop will serve as a forum for discussion and sharing of experiences among scholars who have started, or are considering starting, their own digital projects.

Title: Madness in the Colonies

Abstract: What is colonial about psychiatry? What is psychological about colonization? Does an imperial setting change our perception of madness? Can we talk about "madness" or "mental health" in the colonies across time and space? This panel seeks to answer some of these questions, and creates a forum for historians of many different time periods and geographic regions to find common themes, using the lens of colonial madness as a starting point. Each paper demonstrates how a particular set of theories about the mind permitted particular kinds of colonial interaction in particular regions of the world: sixteenth-century Mexico, Crown-ruled India, 1950s Nigeria, and post-colonial East Africa. We hope to imbue the ebbs and flows of economic and political interest across the globe with richer stories of religious conversion, indigenous tea sellers, and the European titillation with a whole spectrum of racial and multiracial identities, showing continuities and ruptures in the way subjects could be known, rethought and scientized.

Title: Making Hearing Aids: Diverse Motivations, Aesthetics and Audiences

Abstract: Hearing assistive technologies have been ubiquitous since the nineteenth century. However, as they fall into the gap between Deaf History and the field of Sound Studies, their origins and development have received little attention. This session complements Mara Mills’ story of USA hearing aids, by exploring them as a lens for rethinking the historiography of hearing in UK, focusing on issues of materials, expertise, gender, class, surgery, physics, physiology, commerce and patents. Using the British collections of acoustic and electronic devices, we examine the experiences and representations of the deaf as both makers and users. Virdi uses the artificial tympanum, a prosthetic for eardrum perforation, to investigate issues of legitimacy and expertise in the making of non-electric air conduction devices. Constructed as a surgical technology, the selection of materials was chosen by the makers largely from ‘proven’ folk remedies and observations upon anatomical dissections of the ear. Sayer’s paper analyzes the collection of hearing aids by FC Rein, housed at the Thackray Medical Museum in Leeds, UK. Evaluating the aesthetics and functionality of these devices through the lens of their design, Sayer considers how they were in part shaped by, and shaped, the changing and contested meanings of ‘deafness’. Finally, Gooday examines the new kinds of early 20th century electrical hearing aid that incorporated amplification techniques from telephony and radio. By exploring patterns of which devices were patented (e.g. Rein company) and which were not (e.g. the state-sponsored “Medresco” hearing aid) he maps changing judgments of hearing aids' trustworthiness.

Title: Making Knowledge Outdoors in Large, Organized Groups

Abstract: Although not unique to the period(s), the number of large groups of scientists and naturalists who organized themselves to make knowledge in outdoor (field) settings grew significantly in the late 19th Century and throughout the 20th Century. Indeed, even without taking the distances covered by interplanetary probes into account (as one must), more miles were covered in scientific exploration, discovery, description, explanation, and revisitation in the 20th Century than in all previous centuries combined. Taking advantage of new modes of transportation, such as railroads that made the interiors of continents newly accessible, aviation, and space flight, scientists and naturalists explored, described, and explained nature in new ways over this period. They also returned with colleagues, often in large groups, to review and affirm their conclusions. The five papers in this session examine quite different forms of organization, at different times and in different places. In context, the differences
between the five papers stand as an affirmation: taken together, the papers make clear that scientific inquiry conducted out-of-doors held an important place in the history of late 19th science and throughout the 20th century; and that historians who ignore such enterprises do so at considerable peril to their understanding of the making of scientific knowledge.

Title: Managing Risk and Uncertainty in Postwar Biomedicine

Abstract: The challenge of analyzing the thinking and practices of postwar biomedicine has led historians of science and medicine to increasingly join forces. Drawn together by common interests in classification, risk management, and institutional protocols – as well as the experiences of individual researchers and patients – historians of science and medicine are now jointly probing the convergence of biological and clinical research. Postwar biomedicine encompasses an incredibly diverse spectrum of research and clinical aims, ranging from answering basic biological questions to improving specific patient outcomes. Mindful of this, our panel focuses on the practices and significance of managing uncertainty and risk in the laboratory, the clinic, and the spaces in between. Through historical analyses of prenatal diagnosis, in vitro fertilization, hemophilia treatments, and breast cancer screening, this panel seeks to examine the various tensions that exist in biomedicine, which result from the differing goals and expectations of physicians, patients, and basic biomedical researchers. Unanticipated or ambiguous outcomes often complicate, frustrate, or endanger the patient-oriented aims of clinical practice, but at the same time generate new research questions, perspectives, and understandings. Careful oversight and cautious approaches are often necessary for producing new and experimentally valuable findings, while at the same time maintaining patient confidence and well-being. As we explore, such management takes place at the level of individual researchers, biomedical institutions, and professional organizations. With this panel, we hope to offer a model for continued collaboration among historians of science and medicine as we jointly examine the practices of postwar biomedicine.

Title: The Material Culture of Music and the Auditory Culture of Science (1800–1960)

Abstract: Following the current issue of OSIRIS entitled “Music, Sound, and the Laboratory during the Nineteenth and Twentieth Centuries,” this session will present current work on historical intersections between science and music. Rebecca Wolf examines discussions about the relevance of material in relation to sound quality. Focusing on improvements of the flute in the 19th century, Wolf shows how theoretical thoughts on and scientific experiments with new materials were used to justify significant changes in the design of the instrument. Peter Pesic emphasizes the productive power of acoustic experimentation for the conception of physical models. In recalling Max Planck’s experiments in musical temperament in 1893, Pesic argues that Planck’s investigations directly led to proposing a truly universal “natural” system of cosmic units. In his paper on the Geiger-Mueller counter, Axel Volmar addresses the interplay of the human senses, scientific instruments, and representation in early 20th century nuclear physics. By evaluating the auditory output of the GM-counter, Volmar argues for a stronger consideration of sound as a medium for the production of scientific knowledge. Focusing roughly on the same historical period, Joeri Bruyninckx studies listening as an observational research technique in ornithology. Bruyninckx follows bird-watchers, naturalists and professional field ornithologists from 1880 to 1930 and traces the various functions that sound recordings of bird song had in forging an emerging community of field observers. Through these narrower discussions on musical instruments, acoustic models, and listening as an observational technique, we intend to expand the epistemological understanding of the auditory culture of science.

Title: The Materiality of Words in Chemistry and Pharmacy

Abstract: What's in a name? The aim of this panel is to explore the linkage between names and material objects – between words and things – in the history of chemical pharmacy over the longue durée. As the field of pharmacotherapeutics developed between the sixteenth and the twentieth centuries, the question of how to pin names to the materials involved, whether the medications or the chemicals themselves, surfaced continually as a point of discussion, controversy, and confusion. All three of our papers focus on the way nomenclature could both
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Title: Metabolic Philosophy: Digesting Biology in mid-20th century European Thought

Abstract: No major branch of European thought – from philosophy to psychiatry to political philosophy — has been untouched by the biological discoveries of the last hundred years. This panel explores the relationship between mid-twentieth century laboratory discoveries and the theoretical understanding of humans, other organisms and the phenomenon of life itself. Each of our three papers examines a particular moment in which a discovery in the biological sciences transformed European thought: the neurologist and psychiatrist Kurt Goldstein examined brain injuries in a series of experiments that led to theories of the mind-brain relation and of the whole organism; the discovery of DNA’s structure transformed anti-mechanist philosophies of life, but not always in compatible ways, as the examples of Georges Canguilhem and Hans Jonas show; most recently, advances in in-vitro tissue engineering have raised hopes that we might create “vat meat” as a new food source, but culturing animal tissue revives questions about the definition of life raised by Jonas and other philosophers of metabolism. By examining these cases alongside one another we will map a history of ruptures and transformations in which the metaphor of “metabolism” helps us to understand the linkages between the history of biology and European intellectual history. This history will in turn suggest an approach to the cultural and intellectual history of science, as we observe how biology becomes not just legible to philosophers, psychiatrists and social theorists but an important form of sustenance for their work.

Title: Metascience in the History of Science

Abstract: If science has a history, then so do ideas about science—namely, metascience. Though this may seem obvious, the histories of science and metascience have proven to be somewhat awkward bedfellows, especially in an age that emphasizes practices, often at the expense of attention to theory. In step with some recent trends, this panel seeks to bring historical efforts to understand and explain the scientific process into dialogue with the histories of the sciences themselves. This approach embeds scientific developments in the shifting conceptual landscape in which they actually occurred, thus affording a new path around anachronism and a way to rethink prominent figures and episodes in the history of science. Each of these papers achieves this effect in a different way. Chitra Ramalingam shows how early debates over the history of photography were really debates over key terms—like discovery, invention, and science—in the understanding of the scientific process. Henry Cowles elucidates how a vocabulary of method—and even “the scientific method” itself—evolved out of mid-nineteenth-century preoccupations with the state of the disciplines and the cultural authority of the sciences. Alex Csiszar asks how science itself became an object of the epistemic practices—organization, quantification, measurement—with which it was associated by the turn of the twentieth century. And Cathryn Carson offers a new view of Martin Heidegger by revealing how his training in the natural sciences led him to meditate on the nature of Wissenschaft in ways that shaped his later, better-known work in profound ways.

Title: Natural History and Natural Philosophy in the Eighteenth Century: Two Arts or One?

Abstract: The distinction between natural history and natural philosophy—roughly, the observation of nature's effects versus the examination of its causes—was one of the most widely recognised borders on the map of
Title: Natural Knowledge, Identity and Authority in Modern Islam

Abstract: This session examines the relationship between moral, political and epistemic authority in the Ottoman Empire and Egypt during the eighteenth and nineteenth centuries. The papers traverse a broad variety of disciplines and a long stretch of time, while retaining a sharp focus on the question of the historical relationship between modern science and Muslim identity. The presenters seek to understand the politics of natural knowledge by analyzing different locations, communities and discursive structures that represent different aspects of modern Islamic culture.

Title: New Forms for Old Things: Experiments in Scientific Story-Telling

Abstract: Shouldn't historians of science also do more than just read/write scholarly books and journal articles? This plenary session brings together three experiments in breaking with the traditional modes of academic history, along with a significant audience interaction, to take on this big, transdisciplinary issue together. The session is dedicated to the proposition that we need new forms to say new things. The three presenters (Ken Alder, Carla Nappi, and Pamela Smith) are collectively exploring our era's renewed interest in how material bodies and things shape worldly outcomes in ways that a narrowly positivist account can never fully capture. This insufficiency prompts us to ask: Well then, how about changing the way we tell our stories? For historians of science, this means retelling the familiar story of how objects, instruments, and practices make science in ways that the reading/writing of scholarly books and journal articles cannot fully capture. We thus offer three experiments in form-breaking and thing-making to open a conversation about the creative possibilities of fiction, music, and art, forms of craftwork that can help us learn to make new things.

Title: Nurturing the Nation, Cultivating Innovation

Abstract: Over the past decade, historians of science have called our attention to the training of scientists and technologists. After all, as David Kaiser asserts, “Scientists are not born; they are made.”(1) This panel enriches the growing scholarship on pedagogy in the history of science by exploring how educational institutions produce and enact their own scientific values. The papers demonstrate how different stakeholders debate and define the relationships among science, technology and the state, where the contested ground is higher education. The panel also considers how notions of science play out across disciplinary boundaries by examining how the goals of scientific training become inscribed into practice throughout institutions. Collectively, these papers address questions including: How are cultural, political and social values intertwined with stated scientific values? How does articulating those values, norms and behaviors transform practices, and how do the practices then inform pedagogy? Ellan Spero examines how the Massachusetts Institute of Technology enacted a very particular form of “technological education” in its laboratories and curricula during the interwar period. Joy Rankin explores how two
mathematics professors at Dartmouth, a small liberal arts college, collaborated with their students to create an innovative culture of interactive computing in the 1960s, at a time when most university computing was limited to scientific disciplines. Shreeharsh Kelkar considers how the incredibly competitive Joint Entrance Exam in India has evolved during the latter half of the 20th century in relation to the values of toughness, fairness, objectivity and subjectivity.

**Title:** The Order of the Interdisciplinary: How the Materiality of Sociopolitics Shapes Interpretations and Representations in Physics

**Abstract:** While there have been a number of history of physics books produced that have attempted to trace the effects of political and social circumstances in shaping the epistemics of the science, few, if any, have attempted to venture to do so from a theory-grounding and interdisciplinary perspective. While it is important to maintain the social historical re-telling on the immediate objects and subjects that shape the science, it lends to a richer and more complex narrative when objects from other areas, such as literature, film, and cultural theory, are included in the re-interpretation and re-consideration of evidences usually neglected in mainstream history of science. Moreover, the historical voices outside the Western world are seldom given the sufficient consideration, which have the consequence of excluding important thoughts and contributions to the development of modern physical sciences. Such voices from the margins are very important for the understanding of the continuity, sociality, and even ideology that brings about the development of the knowledge that reach global dominance, while lending insight into how scientific developments take place in societies that went through a different sort of modernity and modernization than the dominant players in Europe and the US. This session contain presentations that are tied together by their research interest in interrogating the locality, speculativeness, and partiality of knowledge. They all revisit areas of history that have been given less prominence, and even been ignored, through interdisciplinary methodologies.

**Title:** Organisms in Changing Environments: Concepts and Contexts of Adaptability in 20th Century Plant Sciences

**Abstract:** Nowhere is the problem of understanding the complex linkages between organisms and their environments more apparent than in the science of plants. Today, efforts by scientists to predict and manage the biological consequences of shifting global and regional climates depend on understanding how organisms respond morphologically, physiologically, and behaviorally to changes in their environments. Investigating organismal “adaptability” (or “plasticity”) is rarely straightforward, prompting controversy and discourse among and between ecologists and agricultural scientists. Concepts like agro-climatic adaptation, phenotypic plasticity, and genotype-environment interaction (GxE) are key to those debates, and their complex histories have imbued them with assumptions and meanings that are often both opaque and consequential. This session will explore the diverse ways in which organismal adaptability has been conceptualized and investigated in the second half of the 20th century, and the multifarious political, economic, environmental, and intellectual contexts in which those conceptions have emerged and evolved. The papers in this session bring together perspectives from the histories of agriculture, population ecology, evolutionary theory, and plant physiology, cutting across Asian, North American, and British contexts. A case study of Indian plant breeding shows how nationalistic concerns for practical agricultural science led to a divergent research paradigm for plant adaptation than in Britain or America. As a whole, this session highlights not only the diversity of meanings of “adaptability” and “plasticity,” but also the complex linkages between those meanings, the scientific practices and technologies in which they are embedded, and the ends toward which those practices and technologies are employed.

**Title:** Paleontology as an international endeavour in the nineteenth and twentieth century

**Abstract:** For long, the emphasis of the historiography of paleontology has been placed on its celebrated (Western) contributors, in the spotlight themselves for excavating what will come to be valorized as emblematic finds. A
second habitual research focus has been the national scientific contexts (again, typically Western), the guiding and development of paleontological interpretation and theory. Recent historical investigation has aimed at a more integrated and globally balanced representation of the history of paleontology – an approach that fits the international and discursive nature of subsequent discourse more effectively. This session samples such recent shifts by emphasizing the dynamic and international aspects of the paleontological discourse and practice from the second quarter of the 19th century onwards. Fundamental to the developments in this field is a network- and process- oriented approach that will be reflected in the papers; including elements of collaboration and contestation that range from international and colonial contexts to the relationship between scientific discourses and (cultural) images that they have produced. The papers have been selected to highlight different perspectives on these central themes so as to stir discussion on the particular histories that have formed (and still form) our paleontological legacy. By staging these investigations, the organizers not only aim to contribute to rendering a broader history of the field but also to inflect on-going debates in the paleontological discourse itself.

**Title: Paper and Paperwork: Tools of Governance and Science**

**Abstract:** Material practices of writing formed an essential part of knowledge production in science and bureaucracy. However, in order to employ paper as a productive tool in overcoming spatial and temporal constraints, its deft management by a broad array of actors and institutions was required. This panel showcases four ways in which such actors managed paper tools in gathering, transmitting, analyzing and deploying politically-useful knowledge. The first paper shows how the strategic procurement of affordable, quality paper offered the Austrian Habsburg Court Chancellery new means of structuring diplomatic and other forms of political knowledge. The second and third papers zoom in on the material practice of scientific and bureaucratic writing in the context of, on the one hand, the early nineteenth-century Dutch empire in the Malay Archipelago, and the British Hydrographic Office's attempt to survey the St. Lawrence, on the other hand. Each of these initial three papers illustrate how well-managed flows of paper bound geographically disparate sites and actors together. The final paper deepens this theme by tracing the career of a specific paper tool, Labanotation, in German society of the 1930s. By focusing on the procurement, consumption, and circulation of paper around the globe, this panel examines the opportunities and challenges of paper's materiality for scientific and bureaucratic enterprises.

**Title: The Past, Present, and Future of the Physical Sciences**

**Abstract:** The inaugural meeting of the Physical Sciences Forum (PSF) was held at the HSS Meeting in San Diego in 2012. Participants from diverse fields of study discussed the goals and desired outcomes of the PSF including, but not limited to: developing a community of junior and established scholars working in the physical sciences, providing a regular venue in which to discuss issues in history and historiography, and promoting dialogue across subspecialties. This session will help to achieve these goals by fostering conversations about two aspects of the physical sciences: the role of disciplinary identity in framing research questions and methods and the tension in the literature between theory (conceptual development) and experiment (practice). We have asked four scholars at various stages in their careers and with different research interests to provide short historiographical essays on these topics to stimulate discussion among session attendees on the history, present state, and future of the field. Each of the presenters has agreed to keep their remarks to approximately 15 minutes, to provide a foundation for discussion between session attendees and the panel.

**Title: The Pleasures and Dangers of Social Media**

**Abstract:** Social media are the biggest transformation in written communication since Gutenberg. They can offer challenging new ways for historians to learn, collaborate, and communicate; this is not to say, however, that they won’t hasten the demise of scholarship and usher in a new Dark Age of virtual illiteracy. Collective reflection and discussion will be a bulwark against such disintegration. Hence this panel. The experienced bloggers, tweeters, and Facebookers in this round-table discussion will take an open-minded but critical approach, leading the audience through a discussion of some of the most pressing and substantive issues raised by the new media as they relate to
scholarship. Among them: how scholarly blogging is changing the face of academic publishing; crowd-sourcing and other forms of collaborative, participatory scholarship; online archives and the possibly Faustian bargain of easy, instant access to a sliver of a collection’s full holdings; nontextual and multi-media approaches to history; and the creation of individualized communities and their implications for the role of expertise. Remarks will be kept to between 5 and 8 minutes per speaker to allow ample time for what we hope will be spirited discussion among the panelists and audience. Technophiliacs and neo-Luddites alike are welcome.

Title: Plotting the History of European Agriculture: Between urban and rural, knowledge and practice, tradition and innovation

Abstract: Despite its centrality to human history, agriculture has not traditionally been a major focus of attention for historians of science, perhaps because of its framing as the 'other' in relationship to urban development, modern industry, university scholarship and progress. This session reconsiders agriculture's position in historical development. Moving between the eighteenth and twentieth centuries, it presents agriculture as bridging the supposed boundaries between rural and urban, material and knowledge production, nature's three realms, tradition and innovation. The first presentation explores two episodes in which oeconomic chemistry was harnessed to agricultural 'improvement' in the Netherlands during the eighteenth century. Its goal is to suggestively counter the standard historical narrative that links agriculture during the eighteenth century to scientific and economic innovation, while isolating it from the broader context of culture and material production within which it was actually discussed and practiced. The second presentation examines contemporary experiences in Italy, where involvement in agricultural reform stimulated growing interest in the health of livestock. Reformers' agrarian concerns fed academic concerns, which crystalized in the institutionalization of veterinary medicine. The third presentation moves to the German Democratic Republic in the 1970s and '80s to consider the place of agricultural reform and practice in more recent history. Contrary to standard clichés, it focuses on agriculture in a planned communist society to further the session's deconstruction of oppositional categories. It presents agricultural activity as blurring the boundaries between rural and urban, individual activity and social planning, and the spheres of production and consumption.

Title: Postwar Transformations in the North American Medical Marketplace

Abstract: American health was radically transformed in the four decades following World War II. The papers in this panel explore how state agencies, corporate interests and consumer marketing became major pillars of the postwar North American medical marketplace. During the mid-twentieth-century, bacteriological advancements seemingly conquered infectious disease, giving rise to an increase in life expectancy and shifting epidemiological concerns to focus on chronic diseases. These changes in population health were accompanied by simultaneous changes in the political economy of health as funding agencies came to favor potentially marketable medical research. The increased commercialization of American health gave rise to new challenges in regulating the potentially harmful influence of industry, combating medical quackery and adapting public health education strategies to compete with corporate advertising. Our panelists explore this complicated transformation of American medicine, examining the influence of state and corporate funding on medical research (Burrows), public relations strategies pursued by medical researchers (Oosenbrug), new regulatory challenges to combat medical fraud (Boyle), public health threats generated by the mass production of food (Boycy), and the ways in which the pharmaceutical industry shifted its research to maximize profit (Rego). This conversation will engage fundamental questions regarding the relationship between biomedical research, the medical marketplace, and the state, which provide insight into current health care challenges.

Title: The Power of Analogies for Advancing Scientific Knowledge

Abstract: Everyone uses historical analogies to understand current issues and help make decisions about present-day concerns. Sometimes they use those analogies effectively, and sometimes not. The current debate over national
economic policy is rife with historical analogies and sometimes even the same analogues are deployed to support differing positions. There is a long history of the use and abuse of analogs, offering perspectives on how they might be effectively employed in analysis of current challenges. This session will explore the place of analysis using analogies to a set of episodes in the history of technology. The first paper by Catherine L. Newell, University of Miami, explores the use of the American frontier experience as an analogy for modern space exploration. She notes that by situating space as humankind’s “last frontier,” NASA’s efforts became a fulfillment of America’s new manifest destiny. Roger D. Launius, senior curator in space history at the Smithsonian Institution’s National Air and Space Museum, presents a paper on how the analogies of the Antarctic experience to space exploration relate to each other in considering such future space science activities as a lunar base or space station support and a gradual transition from government activity to public/private efforts. Lisa Messeri, University of Pennsylvania, presents a third paper on the story of Apollo training—first how geology became a science for the Moon and then how astronauts underwent analog training on Earth to prepare themselves for lunar geology. The session will be chaired and commented on by Audra Wolfe, Philadelphia, Pennsylvania.

Title: Practices of Human Measurement

Abstract: Modern humans are measured, counted, and averaged beings, turned into sets of numbers and probabilities through biometrics and physical anthropology, census, statistics, and social sciences. The papers in this session seek to contribute to ongoing research on measurement in the human sciences, but with an added nuance: They move the measurement instruments and techniques from the periphery of study to its center, and they shift the focus away from large and well-known projects such as census and life insurance history, craniology, Queteletian anthropometrics and Pearsonian biometrics to smaller, routine, and problem-oriented measurement practices. In three examples, taken from the histories of gynaecology, metabolism research, and criminology, these papers show how practitioners adapted measurement methods from diverse fields in both the physical and social sciences to create unique measurement units, predictive instruments, and diagnostic tools. They also point to limits on the knowledge that measurement, quantification, and indicators could provide. By standardizing knowledge and generating “mechanical objectivity”, these human measurement techniques provided a framework for sorting information and making sense of the complex object “human being”, but at the same time, this variable and diverse object eluded a reduction to numbers and probabilities. Human measurement was thus a contested ground of rival approaches, methods, and ontologies. By focussing on these specific case studies, the papers in this session reveal the hidden ubiquity and diversity of measurement practices in the human sciences.

Title: Private Lives, Public Reputations

Abstract: A significant area of research in the history of science has been the development of scientific reputations: how savants represented themselves as individuals of great virtue and understanding; how they depicted their work as greatly benefiting the public; and how scientists accumulated an increasing amount of social capital over the course of the eighteenth and nineteenth centuries. A related area of research has considered the relationship between private practices of knowledge-making and the public culture of science: how female family members worked at home and in laboratories, although their work often went uncredited; how scientists staged public spectacles to entertain and educate the public; how institutions such as universities and academies superseded private homes as sites of research. This panel seeks to contribute to both of these lines of inquiry by examining how private experiences informed public reputations: how Jérôme Lalande publicly credited his daughter/collaborator Amélie LeFrançois and developed an intimate and emotional framework for her work; how family-owned asylums enabled female directors to obtain a degree of authority and autonomy, provided that these women paid careful attention to their public reputations; how William Herschel sought to justify his speculative astronomical endeavors by carefully modulating discussion of himself and his work. This panel will therefore consider how the experience of private life contributed to public knowledge, how the family proved a valuable tool in shaping public reputations, and how savants cautiously adapted their self-presentations depending on their social context.
Title: Reading Early Modern Science and Technology

Abstract: This panel enriches recent scholarship in the history of scholarly practices by applying the methods of historians of reading to texts of early modern science. It builds on the work of several pioneering scholars who have married the fields of history of science and books and their readers (Ann Blair, Jim Secord, Nick Jardine, Marina Frasca-Spada, Owen Gingerich, among others), as it takes up Jim Secord’s exhortation—in a 2004 contribution to Isis entitled “Knowledge in Transit”—in which he urged fellow historians to approach the history of science as a history of communication, paying attention not only to the development of innovative ideas but also to how such ideas were received, transmitted, and transformed. By considering the reading practices associated with early modern scientific texts across multiple genres, this panel moves beyond the textual fields, such as natural philosophy, history, and literature, most commonly examined by scholars of early modern scholarly practices, by showing how early modern readers approached texts that exhorted them to action in a variety of ways, instructing them, for example, in the construction of geometrical diagrams, the preparation of medical recipes, or the carrying out of mathematical proofs. Simultaneously, it adds a novel perspective on the history of early modern science (a field dominated by narratives of the genesis of innovation) by considering how readers approached texts which offered novel conclusions and methods and integrated them into their own intellectual projects.

Title: Recasting Germany’s Scientific Past

Abstract: German historiography has transformed fundamentally over the past few decades, yet science and technology studies still stand uneasily within it. The newer literature situates German history within the context of leading conceptual frameworks popular in the historical profession as a whole: global history, transnational history, environmental history, migration history, agricultural history, and international economic history. Even histories of individual German states have overturned longstanding received traditions, none more than the history of Prussia. Yet notwithstanding the work of Eric Dorn Brose and David Blackbourn, a significant gap in this historiographical transformation is the near total absence of any consideration of science, medicine, and technology despite their central roles in Germany’s history. This omission is regrettable, for just as German history has changed, so has the history of science, medicine, and technology in Germany. Whereas earlier the so-called “institutionalist paradigm” dominated, historians of science, medicine, and technology have cast much wider nets conceptually, temporally, and spatially. Speakers in this session take the opportunity to integrate these two transformations and, in so doing, question longstanding beliefs about the history of science, medicine, and technology in Germany and its constituent states. In particular they demonstrate how deeply embedded the history of science, medicine, and technology were in social conflicts, bureaucratic transformations, state expansion, and economic developments.

Title: Redefining "Flora": New Directions in the Biological Construction of an Idea

Abstract: This session explores how biologists have conceptualized “flora” during the past two centuries. The floras discussed range from the flora of North America, to the Carboniferous flora, to the flora of the human body. Dierkes examines how Thomas Nuttall created the first continental flora of the United States in the early 19th century, which formed the basis for all subsequent attempts to comprehensively characterize the North American Flora. By taking Harvard botanist Asa Gray’s life-long project on the flora of North America as an example, Hung demonstrates how 19th century botanists changed the concept of flora by stripping its religious connotations and redefining it as a catalogue inventorying species native to a nation. Caomhánach demonstrates how the lack of consensus on taxonomic approaches to flora in the 19th century was an obstacle to the adoption of Darwin’s theory of evolution in botany. Digrius’ investigation of the role of the New Botany in paleobotany and the reclassification of the Carboniferous flora situates the late 19th and early 20th century plant sciences within an evolutionary framework that changed the understanding of “flora” again. Sangodeyi’s paper examines how the “normal floras” of the skin, gut, vagina and mouth were reconceptualized as an integral part of an ecological human body by biomedical bacteriologists in the 20th century and the NIH-led Human Microbiome Project in the 21st century. In sum, this session offers a genealogical or archaeological survey (in a Foucauldian sense) of the term “flora” as a physical
entity, analytical category, heuristic device, and metaphor. By taking “flora” seriously, this session offers insights into current and historical understandings of how human beings conceive of their surroundings and themselves.

Title: Reduce, Reuse, Recycle: Histories of Epistemic Practice in the Human and Life Sciences

Abstract: This panel will explore how techniques of compression, repurposing, and reintegration have shaped epistemologies and their objects from the early modern period through the present. Herbaria, skulls, the world picture and the posthumous paper -- all these are objects of knowledge that have undergone acute scientific and cultural transformation at the hands of new practitioners and changing historical tides. We want to push beyond objects (as interpreted by Rheinberger and Latour) and practices (as underscored by Woolgar and Lynch) to explore the interaction between the two. Our interest in such epistemological practices is threefold: how experts and non-experts have passed such objects from one discipline to another, one book to another, one place to another, or one medium to another; how, over the course of that process, they altered the objects of their investigation; and how those objects were reabsorbed by other practitioners and other spheres of knowledge. This panel takes the EPA's slogan for waste management to illuminate specific cases of material-based practices in the physical, human and life sciences. Narrowing our analysis of materiality to these three mechanisms provides a framework for analyzing techniques and technologies in use rather than simply in development. With a wide historical lens, this panel proposes a set of methods of connecting cultural and intellectual history through objects and their epistemic itineraries.

Title: Re-Thinking Medieval and Early Modern Science

Abstract: This session explores four key problems in the history of medieval science: the artificially separate histories of Arabic and Latin scientific culture; the restrictive periodization of the medieval and early modern periods; the omission of Byzantine science; and the obscurity of magic. Taken together, the papers propose a radical alternative to established (and often erroneous) narratives of medieval science and the Scientific Revolution.

Title: Rethinking the Cold War Scientist: Advisers, Activists, and Archetypes from Sputnik to Star Wars

Abstract: The archetypal “Cold War scientist” derives from the Manhattan Project elites who navigated a troubled course between expert science and conscientious policy. Our session complicates the model by moving beyond the classic problems of the immediate postwar era. The Oppenheimer affair did not cancel the pact between science and government; indeed, the mid-to-late Cold War actually broadened the association in meaningful ways. This dispersion channeled scientific expertise into new institutional sites, even as scientists themselves diversified their political behavior. The scientific community eventually learned to pressure the levers of power both formally and informally—sometimes in the same motion. First, Daniel Volmar considers the attractions and the perils of military-scientific collaboration in digital electronics during the years after Sputnik. Benjamin Wilson then bridges scientific advising and scientific activism through the arms control movement in the 1960s, when scientists deployed their privilege as defense elites in public criticism of government policy. As counterpart, S.M. Amadae offers an interior view of Washington’s strategic rationality as it drew upon, yet diverged from the scientific consensus in the 1970s. Finally, Sarah Bridger describes the rising influence of the New Left, who expanded the expert opinion of professional bodies from a secretive public service to an essential feature of participatory democracy in the midst of SDI. Ultimately, Michael Gordin has the last word on the state of the “Cold War scientist.” Whether a revision or a revolution in archetypes, the Cold War from Sputnik to Star Wars suggests a new direction for future research.
Title: Science & Technology in Zionist Ideology & Imagination

Abstract: From their earliest 19th century formulations, Zionist ideologies of almost every sort found inspiration and solace in modern Western science and technology. Early Zionist polemics often read like scientific utopias, and many later attempts to justify Jewish settlement of Palestine found virtue in the ability of immigrants to modernize the Levant by bringing with them the most advanced European knowledge and techniques. From the very first (and indeed until today), science and technology have served as ideological, political and practical tools for Jews wishing to settle in Palestine and form a state there, funding unique and complicated forms of colonialism and orientalism, and shedding light on the history of the region over the past 150 years.

Title: Science and its History in Educational Settings

Abstract: Contributors will examine the triad: science-history-education. Can history of science help further science education or is it a mere distraction? Has science anything useful to learn from its own history? How much science ought to be taught in a history course? The papers will consider aspects of the relations between science and its history in the educational setting--relations that have not always been easy.

Title: Science as an Agent of Continuity, part 1: Knowledge, Political Authority and Social Stability

Abstract: Much work in the history of science focuses on how natural knowledge has contributed to discontinuity and change. This session and its companion Part 2 (submitted separately) consider the inverse: how people have used knowledge to enable continuity and stability. Here, we examine the connections between knowledge and the reinforcement of existing social, political, and cultural orders. Central to the stories in this session are colonial settings, where cultural transfer faced intense challenges and sometimes proceeded in unexpected ways. While the papers span antiquity to the early 20th century, they illuminate the range of ways that knowledge production has been linked to the on-going reproduction of social stability. Jean De Groot’s paper uses an unusual amphora to consider how practical mechanics created continuities in material culture, even as innovative colonial thinking in theoretical mechanics began to influence Greek philosophy during the 4th century BCE. Heather Peterson examines how 16th century philosophers in New Spain sought to mediate social tensions by arguing for the stability of Spaniard character, capable of being passed down through generations, despite the changes of place. Christine Manganaro explores how emerging practitioners of human ecology sought to naturalize American colonial control over Hawai‘i. Isabel Zilhao shifts the focus back to the metropole, examining how conservative science education was deployed to buttress existing Portuguese political arrangements against a range of challenges.

Title: Science as an Agent of Continuity, part 2: Science for stability and maintenance in industrial America

Abstract: If science is what scientists do, our current big picture of science is badly distorted. Science is mostly not about change. A great many scientists and technical workers have spent their careers striving to keep things largely as they currently are, despite the turbulent world’s determination to do otherwise. Many of these knowledge workers are employed by governments and industries, paid to do routine quality testing and data collection. Others do perform research, less to advance the frontiers of theoretical knowledge than to see if this familiar product can be effectively used in that potential place. Such mundane work rarely inspires undergraduate courses on the history of science, but it is essential to the unprecedented historical transformation of eating, working, and social practices that characterize industrialized lifeways. Building on part 1 (submitted separately) which explored ways that science has been used to create social and political stability, this session examines some ways that science has been used to stabilize the products of (and spaces destroyed by) industrial society. To see how science enables continuity, these
papers look towards less familiar institutions like the Weather Bureau, the National Fertilizer Association, the New Alchemist Institute, and the University of California Extension Service. They interrogate unfamiliar knowledge production practices, including pomological paintings, ecological arks, and Probable Maximum Flood assessments. By emphasizing the themes of continuity and stability, these papers seek to reveal forms of science that have dramatic impacts on the material world.

Title: Science as Performance: Optical Instruments, Imagination, and Trust in Early Modern Europe

Abstract: Recent historical scholarship has demonstrated the intricate interplay between imagination, visuality, and the new optical instruments of the Early Modern period. The artefacts produced by the instruments – visions and images combined through light, lenses, and mirrors – were adapted to serve different narratives of authority and establish boundaries of trust. The themes of visuality, authority, and the imagination arose as instruments were situated in different contexts – from illustrative conventions and the production of authority in text and performance, to the discourse around the meaning of emblematic instruments such as the telescope, microscope, and camera obscura. Through an interdisciplinary approach of theatre studies combined with history and philosophy, this session explores the importance of these themes to the narrative of increasing instrumentalisation in the performance of early modern natural philosophy. The panel examines various uses of optical instruments in seventeenth and eighteenth century Europe. Novel ways of seeing and imagining were differently adapted to a variety of public spheres; printed literature, public lectures and scientific demonstrations, magic shows and theatrical performance. The talks of the panel investigate manifestations of these novel ways of seeing as they arose in Kepler's response to Galileo's telescopic discoveries in 1610, Hooke's public lectures on light in the 1680s, and the magic shows of Gustavus Katterfelto in the 1780s. Converging on the themes of instrumentalisation and imagination, authority and deception, each paper proposes a new understanding of the relations of knowledge, trust, and science as performance.

Title: Science on Vacation

Abstract: This panel asks: what kind of science happens on vacation? We seek to address the variety of scientific practices made possible in places we are not accustomed to looking for them: quantum theory collaborations on holidays at a weekend cottage in the Danish countryside, ornithology work at the Smithsonian while on leave from the battlefield, and communal zoological studies in a hotel in Bermuda. During the late nineteenth and early twentieth centuries, being outside of regulated institutionalized spaces or in between regimented time schedules often facilitated new intellectual, social, and scientific relationships, forms, and practices. This panel closely examines how the history of physics, history of biology and environmental history intersect with spaces and places of work and leisure. A focus on the places and spaces of science, particularly sites that have been considered peripheral to disciplined thinking, brings new historical actors into focus and allows us to ask new questions about the fluid identities of practitioners and their places of work.

Title: Science, Diplomacy, and Security in the Cold War

Abstract: This panel examines the intersections of security, diplomacy, and science and technology in the international context of the Cold War. In each paper, the international spread of science and technology is driven by security considerations, and in each, asymmetry in power between the nations involved in this transfer leads to conscious discussion of the role of science and technology in influencing foreign nations. In Mr. O'Reagan's paper, set immediate following the Second World War, the United Kingdom and France – in cooperation with the United States and competition with the Soviet Union - attempted to exploit and control German science and technology, yet differences in their postwar international clout and perceptions of technology transfer created fundamental differences in their approaches. Dr. Wolfe's contribution, set in the 1960s, demonstrates the increasing breadth of the ties between science, diplomacy, and security through CIA-funded "textbook diplomacy" efforts to reform biology.
education in Asia. Dr. Turner's paper approaches this material from the opposite perspective, that of the "junior-follower" a US-UK-Canadian tripartite, in his study of the decision to integrate the Canadian Department of National Defence from 1964 to 1968. Together, the papers allow discussion of the emergence of scientific 'soft power' and its ties to security and intelligence affairs in the early decades of the Cold War.

Title: Science, Technology, and Medicine during China’s “Cultural Revolution”

Abstract: According to widely accepted historical narratives, the Cultural Revolution was an unqualified disaster for Chinese science, and the advances of recent decades owe everything to the very different policies of the post-Mao era. However, scholars are increasingly questioning standard narratives of the Cultural Revolution, finding a diversity of experience across different areas of the society and suggesting that the period be studied in relation to what came before and after. Chinese science should be no exception to this trend. After all, as Roderick MacFarquhar and Michael Schoenhals have pointed out, “To understand the ‘why’ of China today, one has to understand the ‘what’ of the Cultural Revolution.” We propose a session covering five distinct areas of science, technology, and medicine during the Cultural Revolution. We expect to find important similarities and differences across these areas; moreover, we will ask what kinds of continuities in institutional frameworks, new methods, or cultural understandings about science may be found across the Mao / post-Mao divide, and what explains those continuities. The session will have five panelists and one chair, including one graduate student and five faculty members at both junior and senior ranks. The five papers will discuss issues concerning agriculture, geology, physics, medicine, and science popularization respectively.

Title: Sciences of the Child in America and Russia, 1890-1950: Nutrition, Neuroscience, Health

Abstract: From the late nineteenth century the child population became a major site of science in which a host of new scientific movements, disciplines and paradigms arose. This was especially true of the United States and Russia/USSR between the 1890s and WWII, a period in which these societies were turned into the superpowers of the twentieth century after experiencing historic turbulences of seismic proportions: spurts of rapid industrialization, bouts of economic catastrophe, waves of mass migration, the upheavals of revolution and the devastations of war. The tremendous growth of science played no small part in this history, while the child population became, in Foucault’s terms, one of its prime “supports.” In this period of both hope and uncertainty associated with “modern times,” children came to be discussed (in terms of the values invested in them and anxieties surrounding them) in a way not unlike “the environment” is today. Behind this was the idea that “the child was the father of the man” in the sense that a “healthy nation” and an enlightened and prosperous future society depended on a systematic approach to the physical, psychological and social nurturing of that nation’s children. This panel will explore some key aspects of this history: the scientific concern with child nutrition and physical growth in the Progressive Era US, the neurological and behaviorist framing of child development in 1920s USSR, and the mobilization of the medical sciences in what could be described as the “rebuilding” of the Soviet juvenile population during and after WWII.

Title: The Scientific Examination of Art

Abstract: This session explores the shifting boundaries between science, craft and art in discourses about material artefacts and their preservation. From the seventeenth until the late twentieth century the distinct knowledge regimes of artisans and scientists encountered each other in disputes on best practices and the conservation of works of art. As scientists quite often belittled the knowledge claims of artists and craftsmen, the expertise of scientists in matters of art was likewise mistrusted and scornfully discarded. The more scientists attempted to intervene in the actual making of art, the more they were regarded as being unqualified to speak out on art, and their arguments were considered to be valueless to the artist, the connoisseur or the art collector. This outright rejection of scientific expertise by art lovers underscores the perception of science and art as antagonistic forces in much the same way as C.P. Snow’s famous distinction between the ‘two cultures’. The papers in this session approach the science/art interface from a variety of angles. They address the roles played by several kinds of actors, including instrument makers, museum directors, newspapers and the general public. Theoretical debates are connected to actor’s
strategies and professional interests. Furthermore, the session pays special attention to the Harvard Fogg Art Museum as a world pioneer in the scientific examination of art.

**Title:** ‘Secreta Secretorum’? Sarton, the History of Mathematics, and the History of Science

**Abstract:** In 1936, George Sarton published a small but historiographically significant book on The Study of the History of Mathematics. There, he contended that “the history of mathematics is essentially different from the history of the other sciences in its relationship with the history of science, because … mathematics being far more esoteric than the other sciences, its history can only be told to a select group of initiates.” For him, “[i]f the history of science is a secret history, then the history of mathematics is doubly secret.” It is the realm of what he termed “secreta secretorum.” Yet, Sarton argued, “the history of mathematics should really be the kernel of the history of culture. Take the mathematical developments out of the history of science, and you suppress the skeleton which supported and held together the rest.” This session aims to show that Sarton was both right and wrong: right, in that in 1936 when he wrote, the history of mathematics was largely written by mathematicians who focused on the technical, internal developments of their science; wrong, in suggesting that its history is inaccessible to all but mathematical adepts; right, in stressing the importance of the history of mathematics to a full understanding of the history of science. The four talks in this session both to reflect on Sarton’s pronouncements in light of three-quarters of a century of further research in the history of mathematics and to inform the broader audience of historians of science of recent work in that field.

**Title:** Secretive Informers. Transmitting “Indigenous Knowledge” in Latin America, 16th to 19th Centuries

**Abstract:** One of the most pervasive stereotypes in the history of knowledge and science about men and women of indigenous descent in post-conquest Spanish America is the belief in their intimacy with American nature, the continent’s land, resources and its antiquity. From the earliest years of colonial rule, the figure of the Indian as guide, source and informer, as the sole bearer of inalienable truths about America’s past and its environment, held sway over the imagination of Spanish officials, European “explorers”, and Creole botanists alike. This panel focuses on the transmission of knowledge from the “Indian” to the “outsider” – on the many moments of passage narrated in the history of knowledge and science. The particular emphasis of the panel rests on moments of hesitation, friction or resistance in these interactions and on the stereotypes about Indian slyness or secrecy, the narratives of betrayal and violence, that became fixtures in Creole and European writings about them. Conflictive instances are relatively well documented, for, it was often precisely when the flow of information ceased that the sources left register of the informers that usually grounded their knowledge. Contributions encompass examples from the Andes and Mesoamerica, from the mid-sixteenth, the late-eighteenth and early-nineteenth centuries, and from fields as diverse as law, botany, water management and archaeology.

**Title:** Sharing Science in the Digital Age

**Abstract:** Data has always been important in science, but in the last 50 years the social arrangements for sharing data have become critical in the formation and function of scientific communities. Part of the reason for the changes in data and scientific communities has to do with the digitization of that data, which both can both facilitate and complicate the sharing of data. These four papers examine the historical development of several different kinds of scientific data (digital and otherwise), the social arrangements for sharing them and the moral economies that result.

**Title:** Sketches of a Conceptual History of Epigenesis

**Abstract:** Epigenesis is the embryological theory according to which “organs . . . are progressively formed from, or emerge from, an originally undifferentiated, homogenous [material]” (Smith 1976). The term is usually traced back to William Harvey, for whom it means “the superaddition of parts… out of the power or potentiality of the pre-
existent matter.” But from Harvey onto Maupertuis and Diderot, epigenesis also designates an intersection between a theory of biological development and a theory of the vital potentiality of matter to self-organize. As early as Francis Glisson, we find epigenesis associated with a *metaphysics of life*, a theory of innate potentialities or ‘appetites’ in matter. The way epigenesis is in fact located in between embryology and metaphysics is also apparent in Samuel Clarke’s attacks on Anthony Collins: “It being as impossible that the organized Body of a Chicken should by the power of any Mechanical Motions be formed out of the unorganized Matter of an Egg; as that the Sun Moon and Stars, should by mere Mechanism arise out of a Chaos” (1707). In this panel we revisit early modern epigenesis at three different interpretive levels: a theological context (Goldberg), which explains Harvey’s insistence on the “dignity” of the animals who grow by epigenesis; a matter-theoretic context (Ekholm), examining Harvey and Nathaniel Highmore’s analysis of the particular *matter* involved in embryo growth; and a properly materialist context (Wolfe), in which epigenesis implies that matter has the power to self-organize, beyond the confines of embryological theory.

**Title:** Social Organization and Labor Relations in the American Human Sciences

**Abstract:** In the middle decades of the twentieth century, the empirical human sciences acquired new cultural authority, administrative and commercial uses, and political meanings. With these changes in status and purpose came equally dramatic changes in the social organization of inquiry as it was shaped by new contexts of application in both the private and public sectors. How did changes in the setting, labor process and organizational order of systematic research affect the scientific lives of sociologists, psychologists, anthropologists, human biologists, and other practitioners in various human science fields in terms of career trajectory, daily routines, workspace, and institutional affiliation? In terms of professional identity, values, and norms? And how did changes in these social dimensions of scientific practice, in turn, affect the kind of knowledge that was produced? Historical scholarship on the human sciences tends to focus either on discipline formation and professionalization processes or on the objects of study and the unique epistemic problems they pose to their learned observers. The study of the places and relations of knowledge production has been comparatively neglected. This panel will therefore explore the relationship between organizational form and the ways in which the human sciences identified and approached their object of study. In so doing, we pay particular attention to styles of institutional rationalization, the gendered structure of organizational space, and the continued presence of affect as a problem for experimental psychologists, survey researchers, and biostatisticians from the interwar period to the 1970s.

**Title:** Sources and Resources: A Panel of Curators of Special Collections

**Abstract:** Each of the panelists is a distinguished curator and scholar representing a major collection of manuscripts and printed materials which offer fellowships to scholars at all levels. For about twenty minutes each, they will present information about their collections, opportunities for research and fellowships,and news of successful projects. They will be followed by commentary and questions from and equally distinguished scholar who has used these collections.

**Title:** Stories about science: mediating between a reassuring past and an uncertain future

**Abstract:** Stories about science are both about past and future. More explicitly than other forms of history, the history of science in the public sphere has been intended to draw upon past experience to clarify, in the words of the German historian Koselleck, the horizon of expectation. At times of uncertainty and concern these can be both reassuring and a guide. This session will encompass a theoretical introduction drawing upon the tools of conceptual history to suggest ways of thinking about the links between past and present made by historical reflection in the public sphere. Conceptual history although little used in Anglophone literature has great explanatory potential. So do narrative studies such as those of Kenneth Burke who promoted the value of the “representative anecdote”. This introduction drawing on examples taken from the history of promoting the funding of applied science will be followed by two case studies dealing with the uses of science history in the post World-war 2 period. One will deal
with the promotion of science education, drawing on accounts of heroes of science which provided a group coherence. The other will explore the ambiguity of the experience of the Viral Cancer Program, remembered by some as a victory over a “war on cancer” drawing on the experience of the Manhattan Project but whose history could be told could otherwise.

Title: Teaching History of Science Outside of the Discipline

Abstract: This session will focus on ways in which those of us who teach in departments or programs unrelated to history of science can bring history of science topics, readings, assignments, and interest into our classes or other public venues. The session’s orientation will be practical, with an emphasis on offering tips, techniques, and strategies that use elements of the history of science to motivate students and to increase engagement in a variety of curricular contexts, from undergraduate writing to engineering to ethics. How can we better deploy our subject matter knowledge in the service of our teaching? We envision this session as a forum for exploration of teaching options, particular for early-career historians of science but also for HSS attendees interested in more effective integration of science history with other ordinary curricular goals (e.g., improving student writing, teaching research skills). We expect this session to be heavily discussion oriented and hopefully full of good advice.

Title: Texts as Tools: Rethinking the Cognitive Routines of Early Modern Learners

Abstract: Recent decades have witnessed a rise in studies seeking to examine the cognitive role played by texts in learning environments. Within historical studies, new digital databases have ushered in a flood of printed textbooks and manuscript notebooks that provide deep insight into the making and remaking of knowledge in educational settings. For the early modern period, studies that concentrate on the education of the poor or professional classes focus more on timeless ‘facts’ and less on the day-to-day skills of learning and literacy, thereby framing knowledge as a set point and not as a collection of processes. Consequently, rather than focusing explicitly on the facts being taught, this session concentrates on how facts were being learned and how print and manuscript texts facilitated this active process. Treating texts as tools, our questions are developmentally and cognitively orientated. While recognizing that facts were important, we are more interested in identifying the core skills and routines that allowed students to interface with texts in a memorable, but useful, manner. The foregoing practices will be investigated in relation to the interface skills and routines required by students learning navigation (Schotte), translation (Hsiung) and literacy (Eddy). Using these topics as case studies, we wish to rethink how early modern teachers and learners actually used textual material as cognitive tools during the learning process. Further developing the notion of user-engagement, the panel will encourage the audience to interact with these texts and the panel’s themes by means of a digital image repository.

Title: Transnational Science? Building the Nation Across the Mexican-US Frontier

Abstract: The urge for a transnational turn is clearly gaining ground in history of science. However, this call is usually more discursive than practical. In contrast with debates spurred long ago in other historical specialisms, this impulse is weakly connected to a well-developed critical assessment of the advantages and pitfalls of other approaches such as the national, cross-national and comparative, while most research in history of science is still based on local case studies. There is undoubtedly some interest in our discipline to challenge Eurocentrism and traditional geographical divisions, and to study international circulation. But there is no such thing as a history of transnational science practices yet. This session aims to provide practical reflections on transnational science through three case studies, which deal with 20th-century science in Mexican-US relations by cutting across the abstract platitudes of transnationalist discourses. Mexico and the US are both outstanding examples of nation-states with vigorous and differentiated national histories, in which science, technology and medicine play a major role. Furthermore, the histories of Mexico and the US are closely connected by the social, political and economical mobilization and cross-acculturation of people, objects and knowledge. While the complex US-Mexico entanglement of national, cross-national and transnational phenomena has been previously examined from various disciplinary history standpoints, a consistent analysis is still missing in the history of science. The three papers in
Title: Understanding the Machine in Neptune's Garden: Historical Studies of Technology and Marine Science

Abstract: Historians of science have highlighted the inherently intertwined nature of technology and marine science. In The Machine in Neptune’s Garden (2004), the editors state that the history of marine science must take into account technologies serving as intermediaries between the observer and the observed. Because the nature of marine science requires constant technological intercession, the historical narratives highlighting the relationship between the two are numerous; historians have barely scratched the surface of the myriad technologies that shaped past aquatic investigations. This session will contribute to this historical conversation by highlighting four separate marine investigations in the 20th century that were structured around, and sometimes hindered by, technological interventions. Samantha Muka’s paper examines the problem of specimen coloration in marine taxonomy. By highlighting the technologies adopted to alleviate this issue, Muka demonstrates the technologized nature of a seemingly dry marine science. Alistair Sponsel’s study of snapping shrimp and submarine sonar interactions highlights alternative means by which technology impacts marine science. The improper functioning of marine technologies due to the marine environment formed the impetus for scientific discovery. Penelope Hardy examines the work performed by large research vessels in the 1960s. Utilizing the case study of Scripps’ R/V Alpha Helix, Hardy shows how these vehicles were integral to both scientific research and the formation of a coherent discipline. Finally, Jennifer Martin expands the history of animal tagging into the marine environment. Her work examines the evolution of shark tagging from 1960-1990 and highlights its effect on ecological understandings of the sea.

Title: Visual Epistemology an Early Modern Science

Abstract: In recent decades, scholars have characterized the early modern sciences (c.1500-1700) as fields that placed increasing emphasis on practices of visual observation. The papers in this panel argue that these practices had a fundamental influence on the descriptive sciences of natural history, ethnology and geography. Two key activities in these fields were explaining phenomena to which the observer had privileged visual access, and making knowledge through the processes of recording observations in visual representations rather than via written descriptions. Implicit in such activities were complex visual epistemologies: what elements of the viewed experience must be recorded? How should three-dimensional objects be recorded on a two-dimensional page? How might artists and engravers who had not witnessed something first-hand transform written descriptions of plants, animals and people into accurate, authoritative illustrations? And how could those who travelled to inaccessible places or used equipment that allowed them privileged visual access, such as telescopes and microscopes, argue for the epistemological authority of their contributions? This panel explores the epistemological assumptions, claims and shifts associated with printed media in order to explain why the process of representing something visually constituted knowledge-making and paradigm-shifting practices in this period, rather than being mere information-recording and transmitting activities.

Title: What It Means to Be a Mathematician: Post-WWII Mathematics in Search of Identity

Abstract: Following the Second World War, particularly with the rise of "Big Science," the institutions and subjects of natural scientific research underwent profound shifts. This panel focuses on the corresponding transformations in the discipline of mathematics – less conspicuous, but equally significant. While mathematicians lacked the impressive experimental apparatus most often associated with Big Science (electronic computers being an important exception), they were nonetheless active participants in the postwar environment of military contracts, philanthropic funding, research institutes, burgeoning student and researcher populations, and many of the other features one associates with postwar science writ large. Looking at a variety of contexts (the United States, France, the Soviet Union, and international organizations), we examine the norms and structures of postwar mathematical communities as their participants adapted to the evolving environment and strove to define their role in the postwar academic world. Postwar mathematicians had to renegotiate their personal and professional identities in relation to shifting
patterns of mathematical education and research, new regimes of personal and institutional sponsorship, evolving university and national politics, and participation in their broader societies. Was postwar mathematics a foundational and indispensable tool for the advancement of every science or an arcane and esoteric specialty fit only for eccentrics? Was mathematics largely a profession of individual researchers or an occupation for closely interacting collectives? How did mathematicians blend participation in existing infrastructures of research and education with the creation of alternative structures and socialities? In short, who, what, and where was the postwar mathematician?

Title: When Mathematics Mattered

Abstract: Since the 19th century higher mathematics has been viewed as self-contained, insular, and entirely apolitical. But things were not always so: In the early modern world mathematics was the science of world order, and questions of political, religious, and cultural order were intimately bound with attitudes towards mathematics and its different techniques. Mathematics, in other words, played much the same role in the early modern world as the environmental sciences do today: particular practices and doctrines carried broad cultural and political implications. The papers in this panel will explore the ways that mathematics played a central role in religious, political, and cultural debates in the early modern world.

Title: Where is the History of Science in the History of Capitalism?: Roundtable

Abstract: A proliferation of scholarship on economic life has been one of the most striking trends in historiography in the twenty-first century. Historians of various chronological, geographic, and thematic perspectives have converged upon the peculiar historical development of capitalism as a guiding problematic. This new perspective on economic history seeks to understand predominant modern economic patterns as the product of contingent cultural changes that cannot be explained by deterministic models. Notably, this new history of capitalism bears many vital similarities to the sociocultural approaches that, since the 1980s, have proved so productive in advancing historical understanding of how scientific knowledge is made. Both histories, of “science” and “capitalism,” attend to the importance of practices, materials, and spaces in shaping how people understand their world, while rejecting technological determinism. Both appreciate how social and institutional contexts shape patterns of thought, while also taking seriously the motive force of ideas themselves. As a result, science and capitalism both represent particularly challenging—and therefore especially fruitful—targets for historicism itself. And yet, the fields have too infrequently been in direct conversation. We hope that this roundtable discussion can begin a broad conversation about where the history of science can inform the historical understanding of capitalism. Drawing upon recent scholarship and primary research, participants will discuss five key thematic intersections: "labor," “(re)production,” "value," “regulation,” and “philanthropy."

Title: Who Counts? Responses to Natural Challenges in Cambodia and Vietnam

Abstract: The quantification of biota and of natural phenomena has been an integral part of scientific methodology for hundreds of years and use of the resulting “numbers” has become an equally integral part of the decision making process for most governments. Beginning in the late nineteenth century, French-controlled governements in Vietnam and Cambodia sponsored research institutes that quantified wild and domestic biota and other natural phenomenon, such as weather, that could affect the colonial economy. This panel presents case studies of governement policies associated with counting in these two countries, linked by a colonial past, a border, and similar environmental problems, and explores the surprising consequences of the seemingly simple act of measurement. Michitake Aso will discuss irrigation technologies in the colonial Red River Delta and the government policies shaped by techniques of scientific quantification of water flows. John Marston will examine post-independence challenges presented to villagers in Kampong Cham Cambodia by massive flooding in the Autumn of 2011 and the opportunities associated with land tenure policy afforded to some families as the waters receded. Moving from
liquid to animal, C. Michele Thompson will present information on the unforeseen negative consequences of expanded national parks and reserves intended to conserve, and to quantify, the flora and fauna of post-independence Vietnam including recently ‘discovered’ animals such as the saola. It appears that attempts to predict and control nature in Cambodia and Vietnam may be increasing rather than ameliorating individual differentiation as governments value various human and animal populations differently.

**Title: Wikipedia workshop**

**Abstract:** I will lead a Wikipedia training workshop to explore how historians of science can improve coverage of important topics on Wikipedia. During a defined workshop period, I will go over Wikipedia editing in broad strokes, what history science coverage is like (and what we know about the gender bias that's apparent in history coverage), suggestions for getting started as an editor, and the options for incorporating Wikipedia editing into courses. Then we could have a broader discussion about the good and bad of history of science on Wikipedia, and broader strategy and tactics for improving key history of science coverage as a scholarly community. Before and after that, I will set up shop to give hands-on training to one or a few people at a time, as people's schedules allow. The actual getting started with your first edits is better handled that way than in a large group setting.

**Title: Winning the Science-Ethics Wars: Historians, Philosophers, and Bureaucrats**

**Abstract:** Ethics in science currently attracts more attention than at any other time before: Centers, conferences, journals, websites, and courses proliferate and expand at a dizzying pace. Is this a sign of progress or of frustration for lack of progress? Compliance with rules and regulations is the topic most frequently discussed. The majority of university courses focus on the responsible conduct of research—in essence, a litany of rules. Is this enough? Is it awareness of the rules that make scientists ethical? Or, is it their consciousness and morality? What can history of science teach us from past paradigms? And, what does philosophy of science have to offer in this respect? What are the challenges when addressing ethical issues in the making of science and how can we produce ethical scientists? The proposed session will elaborate on the role of our discipline and profession in science-ethics discourse and education.

**Title: Writing the History of Scientific Academies**

**Abstract:** Many scientific academies were created centuries ago, amid contexts quite different from today. How have these academies adapted and survived? What functions do they serve? This session looks at two prime examples: the Royal Society, a product of early modern Britain over 350 years ago, and the U.S. National Academy of Sciences, created 150 years ago during the American Civil War. The session papers present research from parallel projects underway to write new histories of these institutions.

**Title: "Your Work in One Minute"**

**Abstract:** The HSS Graduate and Early Career Caucus is hosting a one-hour lunchtime workshop on the craft of the elevator pitch. How do you explain your research, passion, and work in a minute or less? Whether you are seeking a job, grants, or admission, the articulate pitch is a critical skill for the early careerist and established professional alike. This workshop session focuses on improving critical short-format communications in a group format. Participants should be prepared to practice their own work in order to learn how to make their presentation effective and more confident. Leaving the workshop with their own elevator pitch, they will have a chance to try it out immediately on their fellow scholars at the HSS annual meeting.
Abstract: In the last decade, previously unavailable sources including the Personal Papers and auto/biographies of various scientists involved in the discovery of DNA structure, became available, among them those of the three Nobel Laureates F. Crick, J. Watson, and M. Wilkins; the directors of their laboratories, L. Bragg, M. Perutz, and J. Randall; as well as those of other key DNA scientists such as Rosalind Franklin, Erwin Chargaff, Linus Pauling, Alexander Todd, among others. These new sources enable historians to ask new questions, such as why the number of discoverers was changed in 2003 from two to four, (2 in 1953 and 4 in 2003) and whether the confusion over these numbers suggests that the received view of two discoverers (revised in 2003 after half a century) may have reflected a cover up. The paper explores why such a cover up was needed at the time and how it came to include the names of F. Crick and J. Watson, if the discovery was the outcome of a much larger group operation.

Author: Miruna Achim

Title: Idols and Theodolites: Mapping Pre-Conquest Antiquities in Early 19th-Century Mexico

Abstract: Between the late eighteenth and the early nineteenth centuries, the material vestiges of Amerindian pasts, regarded previously as remnants of an idolatrous age, were re-signified as the objects of new scientific disciplines of archaeology, anthropology, and history, and put to new political and cultural uses by both European and recently-independent American nations. As travelers and speculators began gathering objects for private collections or national museums, one trope had remained unchanged: that of the superstitious Amerindian, who endowed antiquities with occult meanings, shrouded them in clandestine practices, and refused to part with them. It was, in fact, the Amerindian’s purportedly illegitimate relationship with antiquities that served as proof of the hiatus between the enlightened ancestors who left the vestiges and the barbarous Indians of the nineteenth century, and as a pretext for others to reclaim “idols” and lands - often through threat and coercion - for the purposes of progress. Nineteenth-century travel accounts conjure up visions of radical alterity, by juxtaposing precision instruments and disciplined exploration practices on one hand, and irrationality, fear, and secrecy on the other. This paper brings together a series of nineteenth-century encounters at some of Mexico’s most celebrated ruins, to suggest that the oppositions around which the story of archaeology has been framed are only surface deep in travelers’ accounts. Historicized readings of these encounters between Indians and outsiders paint a picture of fluid, mutually-entangled practices and endow both Amerindian idols and the instruments yielded by the carriers of progress with ambiguous and complex meanings.

Author: Rodolfo John Alaniz

Title: Marine Dredging, Deep Sea Crinoids, and Wyville Thomson's Late-Nineteenth-Century Rejection of Darwinian Natural Selection

Abstract: The 1876 return of the Challenger expedition and its chief naturalist Wyville Thomson presented a much-anticipated opportunity for evolutionists. Wyville Thomson's scientific team had dredged the depths of the world's oceans and brought back specimens from the bottom of the sea. By the late-nineteenth century, the deep ocean floor had become "Darwin's laboratory," a place to test the “direct action of external conditions on organisms.” According to dominant Victorian marine science, the deep sea was an eternal, unchanging biogeographical space that allowed naturalists to investigate organismal evolution without inconstant environmental factors. Consequently, deep sea marine invertebrates, according to British and American philosophical naturalists, were uniquely suited to the study of organismal complexity. Philosophical naturalists also awaited the crinoids dredged from the Challenger expedition since those crinoids were widely regarded as the “living fossils” Darwin foretold in On the Origin of Species. Sir Wyville Thomson, on the other hand, was certain that his deep sea crinoids offered no support for evolution by natural selection, thereby offering a serious challenge for an alternative to Darwin's theory. This presentation explores the 1880s dispute between Charles Darwin and Sir Wyville Thomson regarding natural selection. The use of biological specimens in the Darwin-Thomson debate illustrates the complex
interactions between marine evidence, rare natural objects, and late-nineteenth-century alternatives to Darwinian natural selection in the history of evolutionary theory.

Author: Ken Alder

Title: A Biography of Marie Curie, by Her Bicycle

Abstract: This essay is part of a larger project in the history of material culture organized around the proposition that things tell stories. It asks: What happens when we put particular artifacts at the center of our historical accounts, not just as objects of historical analysis, but as witnesses to historical change? Its answers that question by letting things tell their own stories. In this case, the biography of a person. There have been many biographies of Marie Curie, more than almost any other scientist. The most famous of these was written by her daughter, Eve, based on a scrupulous examination of sources, and of course on a daughter's understanding of her mother's life. What would it mean to have a biography of Marie told by her bicycle? Marie and Pierre Curie purchased identical bicycles as a wedding present and took them on their honeymoon on the eve of her famous investigations into radioactivity. Marie continued to ride and repair her bicycle through all her years of discovery, fame, infamy, and martyrdom. What can this bicycle tell us about Marie, her status as a scientist, a wife, a mother, a feminist, an immigrant? One of her most famous sayings was: "In science, we must be interested in things, not in people." This paper investigates this proposition in the form of an imaginative tale.

Author: Amir Alexander

Title: The War Against Disorder: The Jesuit Victory over Indivisibles

Abstract: In the 17th century, the Society of Jesus engaged in a prolonged campaign to suppress the method of indivisibles, precursor of the calculus. It took decades, but by the 1670's they had succeeded in effectively suppressing the mathematics of indivisibles in its own birthplace -- Italy. Why did an obscure mathematical technique take on such significance for a religious order whose mission was combatting Protestantism and saving souls? The reason is that mathematics for the Jesuits was the science of universal order, which to them meant geometrical order. Logical, hierarchical, and irrefutable, it represented their ideal world order—a seamless theocratic hierarchy with the Pope at its apex, buttressed by the absolute truths of Catholic theology. Infinitesimals, in contrast, were obscure, paradoxical, and based on a vague material intuition, exactly what mathematics must never be. To the Jesuits, if infinitesimals were acknowledged as legitimate mathematics, then their entire vision of universal order was in jeopardy.

Author: S.M. Amadae

Title: Taking the US from MAD to NUTS: James R. Schlesinger’s Role in President Carter’s Strategic Policy

Abstract: President Carter’s abandonment of anti-nuclear ambitions for even more robust nuclear goals is as legendary as it is counter-intuitive. Political scientists have argued that the strategic shift was logically consistent with Herman Kahn’s On Thermonuclear War. By contrast, this paper critiques the standard narrative through the arguments, cabinet-level alliances, and strategic momentum of RAND defense intellectuals during the Kennedy and Johnson administrations. In particular, it highlights James R. Schlesinger’s defense-rationalist background and his bureaucratic savvy in the construction of Presidential Directive 59, Carter’s controversial nuclear targeting order of 1980. Although the precise motivation behind PD-59 is as yet poorly understood, this paper draws on an effort to understand the scientific arguments underlying the strategic debate between Mutually Assured Destruction (MAD) and Nuclear Utilization Target Selection (NUTS). This latter theory eschewed the classic “strategic balance” while incorporating nuclear options into more numerous conflict scenarios. The overall trajectory of this research has been to show that whereas MAD was an inescapable fact, it was logically incoherent to the defense-rationalist paradigm and thus only NUTS offered a rational basis for national security. Schlesinger’s unique fingerprints on flexible response theory, countervailing policy, and commitment to hegemony show that his doctrine stands between Thomas Schelling’s staunch advocacy of MAD on the one hand, and neconservative worries about extreme vulnerability and epistemic uncertainty on the other. His impact on the Carter strategy is another prime example of how defense rationalism made an aggressive posture—in this case, NUTS—appear as the only scientifically acceptable strategic policy.

Author: Eli Anders

Title: “Careful Consideration” and “Due Discrimination”: Bloodletting, Individuality, and Scientific
Medicine in Late Nineteenth-Century Britain and America

**Abstract:** This paper argues that, rather than fading into the darkness of discredited medical practices, bloodletting served as an important terrain of epistemological contestation and professional identity formation in late nineteenth-century Anglo-American medicine. Between 1870 and 1900, many physicians supported the use of bloodletting in a number of clinical conditions. Advocacy of this procedure was a response both to 'irregular' practitioners, who had sharply criticized bloodletting, and to proponents of laboratory-based medicine, who believed that medical science had disproved its efficacy. Debates about bloodletting served as argumentative spaces in which physicians articulated ideas about professional identity and the relationship between bodily interpretation at the bedside and the course of medical progress. The specificity of individual bodies and populations played a central role in these debates, as physicians argued over which characteristics (age, place, habits, temperaments) indicated venesection, and whether social changes such as urbanization had rendered patients too feeble to be bled. Even as laboratory methods gained prestige and prominence, arguments about bloodletting show that discerning the individual qualities of specific patients remained a vital means of establishing therapeutic expertise and guiding medical practice. Using the example of pneumonia, this paper shows that discovery of the disease’s bacterial etiology did not resolve the dispute over whether bloodletting was effective; it merely shifted the discussion to how therapy could best be tailored to address the interaction between bacteria and an individual patient. For both bloodletting advocates and critics, attention to bodily individuality and therapeutic specificity was an essential aspect of clinical practice.

**Author:** Warwick Anderson

**Title:** Postcolonial Ecologies of Parasite and Host: Making “Tropical” Medicine Cosmopolitan

**Abstract:** The interest of F. Macfarlane Burnet in host-parasite interactions grew through the 1920s and 1930s, culminating in his book, Biological Aspects of Infectious Disease (1940), often regarded as the founding text of disease ecology. Our knowledge of the influences on Burnet’s ecological thinking is still incomplete. Burnet later attributed much of his conceptual development to his reading of British theoretical biology, especially the work of Julian Huxley, and regretted he did not study Theobald Smith’s Parasitism and Disease (1934) until after he had formulated his ideas. Scholars also have adduced Burnet’s interest in natural history, the clinical and public health demands on his research effort, and his earlier investigations of bacteriophage, among other influences. In this paper I want to consider additional influences on Burnet’s ecological thinking, focusing on his intellectual milieu, the setting of his research in a settler society with exceptional expertise in environmental studies. In part, an “ecological turn” in Australian science in the 1930s, derived to a degree from British colonial scientific investments, shaped Burnet’s conceptual development. This raises the question of whether we might characterize disease ecology, and other studies of parasitism, as successful colonial science, perhaps even as postcolonial science.

**Author:** Noam Andrews

**Title:** Training for the Abstract: Geometry and Visual Culture in Early Modern Europe

**Abstract:** The integration of visuality into the teaching of geometry within 16th century “mixed mathematics” is emblematic of a shift in priorities away from the transcendent and towards a set of conceptual geometrical operations inspired by the properties of generating geometrical objects, albeit visualized in two dimensions. The resultant conception of "abstraction" substituted the theoretical geometrical exercises and definitions of Euclid (an abstraction in which geometry was divorced from real world application) for a theoretical geometry used to teach perspectival construction (the realistic rendering of “abstract” geometry on paper), making use of novel graphic manipulations of information. Exploring the valences of the popular Lehrbücher for teaching geometria and perspectiva in Germany reveals a vibrant mathematical culture predicated upon supporting forms of primarily drawn epistemologies and an inroad into understanding the contributions of artisans/mixed-mathematicians to the way that geometry was conceptualized, taught and used in early modern Europe. A continuous body of geometrical knowledge served as the backdrop to the various pursuits of mixed mathematics, representative both of a common intellectual and measurement-based skill set and the overarching importance of “pure” and “applied” geometry to the fundamental identity of the 16th century mathematician. Eloquently, if subversively, thematized in the Lehrbücher, this tension between the abstract and the concrete, the real and the hidden knowledge that underpins the real, define a politics of materiality and abstraction present in the increased use of geometry to teach drawing in this period and in the perceived capacity of geometrical study to curb civil unrest.

**Author:** Rachel Ankeny

**Title:** Biologists and Sharing Practices in 20th century Organism-Based Communities
**Abstract:** This paper explores the norms and commitments associated with sharing practices among researchers working with model organisms. We trace what we argue is an unique ethos associated with organism-based communities—such as those centered around Arabidopsis, C. elegans, and Drosophila—grounded in part in distinct sharing practices. We trace the sharing practices associated with strains and other material resources, techniques and methods, and data associated with this type of research as well as the specific mechanisms (including digital infrastructure) within these communities that support and reinforce these practices. Through a series of case studies focused on key model organism communities, we explore successful models for sharing and their epistemological implications for contemporary biology.

**Author:** Peder Anker

**Title:** The Environmental Antagonist at the Center Stage?

**Abstract:** The work of the geologist Ivan Th. Rosenqvist undermined in the opinion of Gro Harlem Brundtland efforts to halt European industrial pollution of sulfuric acid, some of which ended up as acid rain in her native Norway. His research made him in the 1970s into an anti-environmentalist in the eyes of his opponents. Yet he claimed he cared for nature and that his scientific work was in the world’s best interest. To him the ecological debate was an issue of which rationality and whose knowledge one should trust in efforts to protect nature. This paper will lay out the scientific background and Marxist perspective of Rosenqvist, followed by a discussion of how he and some of his colleagues understood nature and its resources. These views will be placed within environmental debates in Norway and beyond, arguing that his alleged anti-environmentalism should be understood within the context of competing socialist styles of reasoning as well as the disunities of sciences. This paper will reverse the current mood of environmental history writing by letting a key anti-environmentalist take the lead while a series of environmentalists will emerge in his shadow. Will placing the antagonist at the center stage enrich our perspectives on environmental affairs?

**Author:** Karl Appuhn

**Title:** Agrarian Reform and the Invention of Veterinary Medicine in Eighteenth-Century Italy

**Abstract:** In the eighteenth century a variety of groups and institutions—from the new bourgeois academies to growing state bureaucracies—sought to make agrarian reform one of the central economic and natural philosophical projects of the age. In larger states such as France and Prussia, agrarian reform became bound up in debates over national economic and military power. In smaller states, such as Venice, autarchic dreams of nutritional self-sufficiency tended to dominate. Historians have long considered such debates central to Europe’s eighteenth-century revolution in agrarian productivity, which included the introduction of new staple crops, property regimes, and agricultural techniques. Lost in this emphasis on property and plants is the parallel development of new forms of intensive stock-keeping, especially of beef cattle. Proponents argued that increasing the availability of meat would lead to healthier human populations. However, increasing stocking densities raised fears of more frequent and intense epizootic “cattle plagues”, which were already a continent-wide problem by 1700. Therefore, agrarian reformers looked to the medical professions for help. The result was the rapid institutionalization and professionalization of veterinary medicine in European universities. The traditional medical faculties were largely skeptical of this development, arguing that the practices of rural “cow-leeches” and farriers did not belong in the medical curriculum. This paper will use the case of Giuseppe Orus (1751 – 1792), the first chair of Veterinary Medicine at Padua, to analyze the ways in which agrarian reformers sought to elevate animal health as a central feature of their larger economic and scientific project.

**Author:** Tal Arbel

**Title:** The Moral Life of Scientific Survey Research

**Abstract:** An offshoot of the scaling up trend of scientific research endeavors in the early Cold War, the academic survey research institute (SRI) – a uniquely postwar intellectual and institutional configuration most commonly associated with the Bureau of Applied Social Research at Columbia University – was in many senses the emblematic form of an epistemico-organizational sea change in the American social and behavioral sciences in the 1950s and 1960s. Combining “applied” work for government or private clients and “basic” university science, the SRI came to stand for the emergence of an administrative style of organization and an engineering standpoint in the empirical study of social institutions, behaviors and attitudes. Employing armies of highly specialized scientific workers organized in project-based teams, and characterized by an efficient, standardized labor process, hierarchy and control, it resembled an industrial operation more than a traditional research organization. Their detractors tended to portray these institutes as bureaucratic machines that threatened to bring an end to the humanistic ideal of social inquiry and rob social science of its ethical raison d’être. This paper argues that in
contrast to popular representations these places engendered tightly knit technoscientific communities that were radical in their
gender composition, in mixing academic rank, in modes of interaction, collaboration, and authorship. Analyzed as a new
technology of knowledge production and form of scientific life, the history of the SRI form speaks to the way in which
practices, rationalities, and materials of data-intensive human science shape and are shaped by social arrangements and moral
economy.

**Author:** Michitake Aso

**Title:** Irrigating Numbers: Evolving Claims of Water Flow Management and Measurements in the Red River Delta

**Abstract:** This paper examines water flow management technologies, and their associated measurement techniques, in the Red River Delta during the twentieth century. When the French colonized Vietnam, they inherited sophisticated irrigation and flood control systems from the previous rulers. French engineering often simply sought to extend dike and canal networks that already redirected excess flows of water during floods and redistributed needed water during times of drought. Under both the Nguyen dynasty and the colonial regime, these technologies signaled the governments' willingness and ability to take care of the people they ruled. The colonial era, however, brought new techniques of counting to bear on the problem of water management across Southeast Asia. In the Red River Delta, these techniques included detailed measurements of geographical features as well as minima and maxima of water flow in various rivers. Armed with these more sophisticated techniques, French colonial officials and engineers sought to intervene both intensively and extensively in society. In addition, developing climate science allowed the visualization of storms and the historical fluctuation of water levels in numerical terms. Unexpectedly, storm tracks drawn up by meteorologists and other images of circulating water made their own rhetorical claims, compelling colonial officials to act in a certain manner. In this way, the French colonial government expanded the numerization of water management even as it attempted to redefine who counted.

**Author:** David Attis

**Title:** Careers in Policy and Business

**Abstract:** David Attis holds a PhD in the history of science from Princeton University and a bachelor’s degree in physics from the University of Chicago. He will discuss his experience as a Practice Manager with the Education Advisory Board as well as in other policy and business-related positions he has held.

**Author:** Malte Bachem

**Title:** The Unmeasurable Serial Killer: Epistemic Shocks around 1930

**Abstract:** By the late 19th century, German criminology and criminalistics had earned a reputation as highly modern expert cultures. Their concepts and techniques were surrounded by the aura of scientific objectivity. Methods such as fingerprint indication, bertillonage, and photography, as well as an effective administration, stabilized their epistemic authority. Within this setting, the criminal individual appeared as a measurable and administrable entity. When a series of murders took place in Düsseldorf in 1929, however, a number of established routines failed. The police gathered a vast corpus of knowledge on the unknown criminal from several witness statements and information at the crime scenes. Despite all the information the police were in a crisis: The murderer could not be identified. The case of Peter Kürten, which inspired Fritz Lang's movie “M”, shocked not only the public but also the self-conception of criminologists. The police investigators' response to this shock of objectivity was to develop the first profile in the history of criminology. This paper asks: How was this method legitimized? And how did it configure the unknown criminal?

**Author:** Kathleen Bachynski

**Title:** Kickstarting Scholarship: Crowdsourcing as a Historical Tool

**Abstract:** “Crowdsourcing” history—using social media to collaboratively raise and address historical questions—offers exciting possibilities for scholarly research and teaching, but it also suffers from significant limitations. The historically oriented (primarily Civil War-era) blog posts of Ta-Nehisi Coates, senior editor at The Atlantic, offer an opportunity to reflect on how both professional and amateur historians might use this type of model to engage and collaborate with the general public. Coates’s blog is notable for the number and wide-ranging expertise of the commentators it attracts, including not only amateur historians but also professional scholars. His posts include Coates posing a question he knows nothing
about (“Talk to me like I’m stupid”), conversations focused on particular documents or books, and discussions of historical questions raised by media coverage of current events and commentary. Blog conversations have enabled the formation of a diverse intellectual community, a sizable platform for disseminating and discussing primary source materials, the opportunity for knowledgeable amateurs to contribute, and the ability to more rapidly and directly engage with historical questions and debates sparked by contemporary news events. Yet contributors’ background and the authority from which they speak is sometimes unclear, the format demands intensive, time-consuming moderation, and discussions often exhibit an inconsistent degree of rigor and thoroughness. While crowdsourcing history on a public blog provides rich possibilities for engaging with a broader audience and involving readers in historical thinking, such conversations require careful management and do not invariably yield productive scholarly discourse.

**Author:** Renzo Baldasso

**Title:** The Graphic and Typographic Context of Regiomontanus’s Books (Nuremberg 1473-1475)

**Abstract:** The rise of the visual dimension is an important trend in early modern science, and it is epitomized by Galileo Galilei’s claim in Il Saggiatore (1623), that the Book of Nature “is written in the language of mathematics, and its characters are triangles, circles, and other geometric figures.” Its intellectual roots are the efforts of mathematical humanists to recover the figures implied by ancient scientific texts---these figures, if present, were unstable marginalia in the medieval codices. Their recovery and canonization as text let to the rethinking of the epistemological value of visual representation and graphic analysis. Visual reasoning offered new means to study nature and establish scientific knowledge, means that bypassed the limitations of dialectic and syllogistic arguments. Johann Müller of Königsberg (1436-1476), better known as Regiomontanus, was one of these humanists; his achievements in astronomy are matched by his accomplishments as publisher. His books are distinguished for typography, mise-en-page, press-work, and for the presence of many figures and diagrams, some printed by metal-imprints rather than woodcuts. My paper places Regiomontanus’ books in the context of early printing--north and south of the Alps from 1467 to 1476--to explain his graphic choices and typographic innovations, and considers their important legacy from the perspective of early printers through the early 1480s. Overall, my paper supports the claim that the material form of books, and specifically the graphic dimension of printed information, shaped the meaning of the contents of scientific incunabula and the practice of early modern science.

**Author:** Melinda Baldwin

**Title:** Stokes and Tyndall: Correspondence, Referee Reports, and the Physical Sciences in Victorian Britain

**Abstract:** George Gabriel Stokes (1819-1903) was one of Victorian Britain’s most respected men of science—and one of its most prolific correspondents. This paper analyzes the correspondence between Stokes and his fellow physicist John Tyndall, using material from the John Tyndall Correspondence Project. This correspondence reveals that personal letters were central to Stokes’s work as the physical sciences editor of Britain’s most prestigious research journal, the Philosophical Transactions of the Royal Society. When Stokes thought Tyndall should make changes or corrections to a paper Tyndall was preparing for the Transactions, he used personal correspondence, not referee reports, to communicate his suggestions. This correspondence noticeably shaped Tyndall’s published papers. Even though Tyndall knew his papers had already been accepted for publication, he refined his arguments and reconsidered his theories as a result of his correspondence with Stokes. Their exchanges illuminate the influence Stokes wielded over Victorian physics—and further suggest that the history of correspondence may have a great deal to do with the history of refereeing in scientific journals.

**Author:** Somaditya Banerjee

**Title:** Subaltern Science and Indian Nationalism: Meghnad Saha

**Abstract:** Focusing on the case of physicist Meghnad Saha (1893-1956), this talk explores how modern science managed to establish its roots and develop original directions of research in early twentieth century colonial India. The term “subaltern science” is introduced to characterize the very shifting and fragmentary character of science as espoused by Saha. Subalternity is defined by the fact that Saha was forced to re-imagine himself continuously through oppositional orientation towards events and realities of the hegemonic order. Saha’s nationalism was characterized by his close association with the Bengal revolutionaries whose rationale was to use armed struggle against the British for decolonization. The study of such a “subaltern science” which was fragmentary reveals the limits to statist knowledge and agendas. Traditionally the British-Indian colonial interaction has often been described in a binary mode as an encounter between two well defined cultural traditions. This study understands the process as a more complex form of cultural hybridization which provides us with insights into the wider processes of domination and subordination. Saha’s framework in physics which situated agency in
different chemical elements rather than in the selectivity of external stimuli implied that cognition of the physical world could not be easily disentangled from cognition of the social world. My talk will demonstrate that the processes of decolonization were forged not only by mainstream nationalists like Gandhi and Nehru but also in very important ways by that of subaltern scientists like Saha who used science as a tool of nationalism of emerging Indian national identity.

Author: Ana Barahona

Title: Medical Genetics in Mexico. Circulation of Knowledge and the Development of Cytogenetics

Abstract: This work explores the circulation of medical cytogenetics knowledge and practices in the 1960s and 1970s in Mexico. It focuses on the work of the group headed by Salvado Armendares, Fabio Salamanca and Leonor Buentello. Armendares is considered the first Mexican physician with graduate studies in human genetics. He spent two years at the British Medical Research Council in Oxford, in 1964-65 under the supervision of Alan Stevenson. Upon Armendares’ return from England, the first Unit for Research in Human Genetics was created at the Mexican Institute of Social Security, which was funded in 1943 by the Mexican health-care policy to provide medical assistance and health care to the workers at public hospitals. It was in 1969 that Colombian physician Salamanca and Mexican physician Buentello joined the recently created and promising unit. Salamanca had studied cytogenetics at the University of Minnesota and Buentello had returned from a two-year stay in Freiburg, Germany where she had studied virus genetics. The unit on human genetics contributed to exploring the effects of malnutrition on chromosome structure, chromosome aberrations, and the effect of mutagenic agents on chromosomes, and in the late 1970s medical problems with new methods of chromosome banding. Armendares, Salamanca, Buentello and their group, all trained in different academic institutions and at many different times, transformed medical practice at the hospital into a medical research discipline. Their trajectories show the main role played by the clinic and the post-revolution public health policy in the development of human genetics in Mexico.

Author: Marci Baranski

Title: Wide adaptation of Green Revolution wheat: Climate, agricultural science, and the Indian state

Abstract: Indian wheat cultivation changed radically over the past five decades due to new technologies and policy reforms introduced during the Green Revolution, and farmers’ adoption of ‘technology packages’ of modern seeds, fertilizer, and irrigation. Today, the yield gains of last century’s Green Revolution have stagnated. A convergence of demographic, ecological, and climate factors threaten India’s wheat production system. Technologies such as climate-tolerant crop varieties and geospatial models are often invoked as future solutions to counter new climate constraints on crop yields. These technologies are rooted in scientific advancements in genetics, ecology, and plant science throughout the 20th century. Drawing on field research in northern India and archival research of Indian agricultural science annual reports, conference proceedings, and journal articles, I will describe the evolution of the concept of “wide adaptation” in Indian wheat breeding from 1965 to present. Wide adaptation implies adaptability and phenotypic stability of a crop in different environments. Why did widely adapted wheat varieties become a main goal of Indian wheat breeding; how is it reinforced by the Indian scientific and political infrastructure; and what influenced the mid-century development of these scientific and political structures? Throughout the latter half of the 20th century, concepts such as location-specific research emerged and continue to challenge the mainstream approach of wide adaptation, provoking significant controversy among scientists over the pathways of innovation and issues of social equity. My research also examines the on-the-ground consequences of these techno-political trajectories, and the implications for climate change adaptation.

Author: Michael Barany

Title: International Mathematics and International Peace in the Mid-twentieth Century

Abstract: In hindsight, it is hard to see how Warren Weaver could have characterized mathematics, in 1937, as "A wholly non-contentious discipline." From its institutional origins in the supranational mathematics organizations of the fin-de-siècle, the international mathematics community had always been marked by personal, professional, and national disagreements. Yet mathematicians by mid-century had mounted some of the most widespread and successful efforts to extricate their colleagues from war and occupation and to foster international exchanges, and they had many reasons to see themselves as a community above petty national concerns. Many, like Oswald Veblen, exempted mathematicians from ordinary sociality altogether: "The more one is a mathematician," he averred in 1950, "the more one tends to be unfit or unwilling to play a part in normal social groups." Between Weaver's worldly role models and Veblen's social misfits, one finds an emerging figure of the international mathematician—a man above politics but not insensitive to it, a traveller and a scholar, a member of a global society of national differences subdued to a common intellectual cause. My talk follows such international mathematicians as they defined the discipline of mathematics and the (increasingly itinerant) place of mathematicians at mid-century, centering on
the first postwar International Congress of Mathematicians in 1950. What it meant to be a mathematician was tied to both the what and the where of one's mathematics, the whence of one's appointments and funds, and the why and how of one's membership in an increasingly mobile and interconnected disciplinary community.

**Author:** Megan Barford

**Title:** Whitehall-Quebec: Writing Hydrography across the North Atlantic, 1830-1850

**Abstract:** This is an examination of the movement of paper across the North Atlantic in the 1830s and 40s, between the Hydrographic Office of the Admiralty and Henry Wolsey Bayfield, then employed surveying the St Lawrence River and Gulf. As an institution responsible for commissioning marine survey work and the production of Admiralty sea charts and sailing directions, the Hydrographic Office was a bureaucracy specialising in long-distance communication. The case of the St Lawrence provides a way of looking at the function of letters in place of talk in the Hydrographic Office, as Bayfield did not periodically return to London, precluding the possibility of shop-talk in the office, a significant part of the work of other surveyors. The case also highlights some of the difficulties caused by the materiality of paper, with shrinking charts leading to arguments about engraving techniques and destroyed documents further complicating a correspondence network often contingent on personal relations between a Royal Naval officer and merchant masters. The resulting considerations are of the paperwork on paperwork: how long distance bureaucracy devoted to the production of paper tools might function in practice, and how communication between locales might be (difficultly) achieved across a particular space.

**Author:** Megan Baumhammer

**Title:** Starry Messengers and Imaginative Journeying: Reading and Visualising in Kepler’s Dissertatio cum Sidereo Nuncio

**Abstract:** In 1610 a copy of Galileo’s Sidereus Nuncius was sent to Rudolph II, and both the Holy Roman Emperor and Galileo asked the Imperial Mathematician, Johannes Kepler, for his opinion on its contents. Kepler quickly wrote a letter in response to the Sidereus, sending it back a week later. This letter formed the contents of Kepler’s Dissertatio cum Sidereo Nuncio, published just two months later. While much scholarship has investigated its political and authoritative aspects – since the Sidereus is such an important text for the history of science and instrumentalization – there is more to be said about the Dissertatio and Kepler’s interaction with the telescope through the imagination. This paper explores Kepler’s response to the Sidereus as a process of imagination in reading and through images. It pursues the question of imagination in readership and authorship; of the images and text of printed books and their relationship with the instruments that were used in their creation. Why was Kepler so certain about the discoveries of the telescope if he had not yet seen through one when writing the Dissertatio? What is it about the instrument and the texts that surround it that excite Kepler about the shape and expanse of the universe? I argue that Kepler’s response to the Sidereus demonstrates interplay between the instrument, texts written about the instrument, images produced with instruments, and the imagination in the Early Modern period; that the imagination plays the leading role in the power of this hastily written little document.

**Author:** Barbara Becker

**Title:** The Correspondence of William Huggins: Putting Meat on the Bones of the Scientist’s Account

**Abstract:** Near the end of his long career, English amateur astronomer William Huggins (1824–1910) wrote “The New Astronomy”, a captivating retrospective essay that portrayed his own career’s development as synchronous and near-symbiotic with that of the new science of astrophysics. First published in a popular magazine and later excerpted by biographers, “The New Astronomy” became part and parcel of the traditional “scientist’s account” of astrophysics’ origins. But to take this essay at face value is to fall into an alluring trap. It is a synthetic account composed of specially selected events recalled many years after the fact by an active participant in them. In this paper, I will use evidence gleaned from Huggins’s unpublished correspondence and notebooks to flesh out the published record and place his pioneering efforts more realistically within the context of Britain’s astronomical community during the last half of the nineteenth century.

**Author:** Etienne Benson

**Title:** Modeling Data and Animals in Movement Ecology

**Abstract:** Movebank is an online repository for scientific data that was launched in 2009. Initially styled "MoveBank" in imitation of the genetics database GenBank, the site aims to provide a central repository for animal movement data collected
using a variety of means, from bird bands to satellite-linked GPS loggers. As of October 2012, Movebank included data from 700 studies submitted by 256 contributors, covering 257 taxa and 39,206 individual movement tracks, where each track represents a single animal. Small in comparison to other online repositories — in October 2012, GenBank contained 157,889,737 distinct sequences — Movebank is nonetheless "big data" for animal ecologists, and its attempt to centralize data archiving for the loosely organized field of movement ecology is unprecedented in its geographical and taxonomic scope. At the same time, Movebank builds on a half-century’s worth of attempts to manage increasingly copious amounts of animal movement data using computerized databases, analysis methods, and visualization techniques. The first such efforts, which encoded movement data on punch cards, processed it on mainframe computers, and visualized it with pen plotters, emerged in the mid-1960s in the context of the development of early electronic animal-tracking techniques. This paper uses this history to examine evolving relationships among methods of data collection, storage, simulation, and visualization in the field of animal ecology as well as the model of the animal that these methods both reflect and reinforce.

Author: Frazier Benya

Title: Making a Place for Bioethics Discussions in the Federal Government

Abstract: The history of bioethics often sees the first federal bioethics commission as a result of the field’s early focus on the ethics of human experimentation and as a reaction to the public discovery of the Tuskegee Syphilis Study. Yet the idea for a federal commission to examine and advise on the ethics of biomedical research has an earlier history starting in the early 1960s that goes beyond abuses in human experimentation and instead focuses on the broader societal implications for biomedical research. This paper examines that history, starting with efforts in Congress in the early 1960s to consider the applications of federally funded research, then detailing the proposal by Senator Walter F. Mondale for an interdisciplinary Commission on Health Science and Society, and concluding with the passage of legislation to creation the first federal bioethics commission. Using the political history as a lens, this paper details the interdisciplinary collaboration that supported the commission’s creation and details how the field of bioethics was defined in the public realm. Understanding how the political attention and support for such a commission developed reveals the influence Congress had on the field’s development and demonstrates that the reactive and proactive categorizations of political actions are often too simplistic. This paper uncovers a richer and broader focus of early bioethics and asserts that the bioethics commission was established swiftly in 1973 because of the earlier work of key Senators.

Author: Lennart Berggren

Title: Escaping the Esoteric: The Present State and Future Prospects of the Historiography of Greek and Medieval Islamic Mathematics

Abstract: In his Study of the History of Mathematics (1936) George Sarton remarked that “The history of mathematics is essentially different from the history of other sciences” and was “never an integral part of the latter” because “its history can only be told to a select group of initiates.” Sarton admits that the sciences, too, contain difficult and recondite conceptions, but this is “largely true of recent science” whereas in mathematics, in his memorable phrase “the trouble begins with the Greeks.” This talk will look at some developments over the last two decades in the historiography of Greek mathematics, and that of its immediate successor, medieval Islam, with Sarton’s comments in mind. We shall see that while, in some respects, Sarton’s comments are as germane as ever it is also the case that much has changed and, to use Sarton’s analogy, the “family tree” of mathematics has many more branches than he had suspected.

Author: James Bergman

Title: From Civil to “Climatic” Time: Seabrook Farms, Operations Research, and the Application of Climatology to Industrial Agriculture

Abstract: In 1946, C.W. Thornthwaite left his position as principal climatologist at the Soil Conservation Service to consult for Seabrook Farms, one of the largest growers of truck crops and distributors of frozen foods in the United States. During his time there, he sought to integrate his conception of climate and climatology to the industrial and agricultural operations of farm and farm. This paper will analyze one initiative Thornthwaite took to reorganize the farm’s harvest schedule around a “climatic calendar” that used the growth of pea plants as a basis for predicting the harvest time. Although Thornthwaite promoted this as an example of the successful application of Operations Research to agriculture, I argue that this initiative is embedded as much in conceptions of climate and of agricultural planning that were developed during Thornthwaite’s time in the New Deal as it was in the World War II-born O.R. By examining Thornthwaite’s work as part of a continuing effort to integrate large-scale planning with the exigencies of an often unpredictable and seemingly unstable environment, we not only understand how planners in the period imagined the porous boundary between human operations and nature, but also how
that very porosity was constructed and managed. Thornthwaite replaced the mechanical clock—that potent symbol of industrial organization—with time based on biological and climatic processes. In one sense, industry became integrated with its environment. In another, the environment became yet another part of industry.

Author: Paola Bertucci

Title: Jokes of Art: Useful Knowledge and the Virtuoso in the 18th Century

Abstract: The cabinet de physique emerged in the eighteenth century as a new space for collecting, displaying and making knowledge. Although collectors had included instruments in their museums even in earlier times, institutional and private spaces uniquely devoted to collections of philosophical instruments were a creation of the Enlightenment. This paper engages with the main theme of the session by comparing this typical eighteenth-century space with earlier cabinets of curiosities and Wunderkammern. In particular, it will focus on the relationship between nature and art and on the ways in which it was reformulated in the cabinet de physique. What did it mean to collect and display philosophical instruments in the age of Enlightenment? What kind of knowledge was produced in the cabinet de physique? I will answer these questions by examining in particular the writings of Jean Antoine Nollet and Sigaud de La fond, together with the collections of the French aristocrat Joseph Bonnier de la Mosson.

Author: Francesca G. Bewer

Title: Fine Arts in a Laboratory: The Fogg Museum and the Emergence of Art Conservation

Abstract: The Fogg Museum is considered the crucible of art conservation in the US and a major contributor to the emergence of the field internationally. Key to the development of Harvard University’s art museum at the beginning of the last century was the notion that it should serve as a “laboratory” – a term associated with science, and inherently a locus of inquiry and experimentation. This paper provides an overview of how scientific procedures and thinking came to be incorporated into the care and study of works here. It examines interactions between scientists, restorers, art connoisseurs, art historians, museum professionals, artists and students that the museum was associated with in the days when the boundaries of expertise began to shift and before the necessity of a dialogue between the different voices was generally accepted.

Author: Anouska Bhattacharyya

Title: Madness in a Colonial Community: Surveying the Nineteenth-Century ‘Native’ Lunatic Asylum in British India

Abstract: The lunatic asylum is often subsumed within colonial historiographies as simply another site in which Europeans implemented colonial power. In 1868, the British government of India surveyed its ‘native’ asylums in the subcontinent using a lengthy questionnaire, an action that could be read as reinforcing this idea of institutions practicing hegemonic power. However, my examination of the surveys reveals a remarkable everyday politics of madness within the asylum walls, a colonial and local politics that permeated these sites of “European science” via chai wallahs (tea sellers), religious leaders and a variety of actors, all of whom created a ‘hybridized proto-psychiatry’ unique to each institution. My paper suggests the ‘native’ asylum in India was not subsidiary to the colonial hospitals, prisons and schools that had been utilized by the British to contain, control and understand their subjects for so long. Instead, I argue the colonial asylum reveals something very specific about the interaction between colonizer and his colonized subject in the nineteenth century: native minds and bodies were complicit in the production of colonial knowledge. There were literally communities of local Indian men and women actively involved in the construction and daily management of British-built lunatic asylums in Northern India. Building on the work of Chris Bayly, Bernard Cohn and, of course, Foucault, I use the asylum lens to reveal similar instances of institutional complicity elsewhere in the subcontinent, and the Empire at large.

Author: He Bian

Title: Reforming Knowledge over the Nature of Drugs: A Physiological Turn in Eighteenth Century Chinese Materia Medica

Abstract: Materia medica texts in the past can shed much light on a society’s material outlook and its natural philosophy. In this paper, I examine a novel attempt at reforming Chinese materia medica (bencao), a mature and diverse genre of medical learning by the seventeenth century, by examining one such work titled <Bencao Quizhen> (Searching for the Truth in Materia Medica, 1769). Huang Gongxiu (c.1736-1795), the author, proposed an alternative plan of classification for
medicines that focused on “the Nature of Drugs” (yaoxing), to replace the old “naturalistic” plan that divided drugs according to their origins. Along with many previous authors in the seventeenth century, he argued that materia medica treatises should offer causal explanation for the physiological action of drugs, rather than recounting their clinical uses at face value. His book stood out as an attempt to sift through previous authors’ idiosyncratic interpretations of pharmacology and contain them with a concise and reliable system. My inquiry will focus on explaining why Huang chose to build his classificatory system upon the notion of the “Nature of Drugs”, a long-standing term in Chinese materia medica, and how should we make sense of the notion of “Nature” (xing) and “Truth” (zhen) in the context of eighteenth century learning? I will also draw a tentative comparison between Huang’s physiological classificatory scheme for medicines and that of William Cullen’s A Treatise of the Materia Medica (Volume 2, 1789), suggesting a possible comparative history of pharmacological imagination in the early modern world. My inquiry will address three key questions: First, what constituted “truth” for Huang, and what were his methods of obtaining truth in this text? Second, Huang refrained from including any illustrations, and replaced the modern world. My inquiry will address three key questions: First, what constituted “truth” for Huang, and what were his methods of obtaining truth in this text? Second, Huang refrained from including any illustrations, and replaced the naturalistic classification scheme of previous materia medica with an order based solely on pharmacological virtues. Why pictorial representation was not considered appropriate for his purpose? Lastly, I will draw a tentative comparison between Huang’s work and William Cullen’s <A Treatise of the Materia Medica> (1789), two roughly contemporary accounts, in order to shed further light on their parallel interests toward pharmacological natural philosophy and good life in an age of expanding commerce and material abundance.

Author: Jordan Bimm

Title: “A Better Man Than Ever”: German Mountaineering and Early American Space Medicine

Abstract: A major concern for the American military during the early Cold War was the perceived weakness of American bodies and minds. Researchers across the human sciences worried that humans were “the weakest link” in new cybernetic man-machine systems, and actively sought ways of making American soldiers better able to function in newly-strategic extreme environments, including the upper atmosphere and outer-space. This paper examines one attempt to improve American military bodies for spaceflight through a series of altitude acclimatization experiments carried out on the summit of Mount Evans in Colorado in 1958, by researchers from the United States Air Force School of Aviation Medicine. This paper focuses on the experiment’s racialized character and colonial roots. Lead researcher Bruno Balke wanted to see if “sea-level Americans” could be trained to show the same levels of physical endurance as “barrel-chested, stocky-legged Peruvian mountain men”. This five-week field experiment will be examined in the context of Balke’s pre-World War Two life as a German ski instructor, sports medicine practitioner, Wehrmacht mountain infantry doctor, and Luftwaffe life scientist. Of particular interest is Balke’s role in the 1938 Nazi-funded Nanga Parbat expedition to Tibet, where he conducted similar experiments on acclimatization. While space medicine is often figured as a branch of aviation medicine, this camp-based episode will show how mountaineering and sports medicine influenced the discipline. It will also show how German ideas from the early twentieth-century about the role of nature in improving human bodies influenced the making of American astronauts during the cold war.

Author: Renée Blackburn

Title: Safety Doesn’t Sell...Unless We Say So: The Airbag’s Role in Federal Regulatory Negotiations

Abstract: In May 1988, the Chrysler Motors Corporation issued a press release stating that the company planned to install driver’s side airbags as standard equipment in six of its car lines. The company intended to lead the way in safety engineering by creating the safest driving experience while responding to consumer wants. However, the Big Three automakers – Ford, General Motors, and Chrysler – had begun developing the airbag in the late 1960s. In the interim, the airbag became a source of contention in which to discuss government-industry relationships involving risk, liability, and the economic advantages of safety. The Big Three had to work within federal regulatory safety constraints that created the basis for a consumer market for safety. Issues with consumer implementation, automakers claimed, came from government regulation that forced large-scale mandatory installation before the technology was “ready.” When asked why they had not implemented this sooner, Chrysler stated that government regulation kept them from creating a safe, reliable product in a timely manner. The Big Three’s engineering teams strove to create an airbag system that would keep vehicle occupants safe, while also negotiating new federal regulatory processes, public concern and skepticism surrounding existing safety features, and attempting to work within the constraints of their own engineering capabilities. Using interviews, technical reports, and press releases in conversation with literatures on risk, automobile design and engineering, and government-industry relations, this paper portrays the ways in which automakers responded to safety, risk, and liability concerns through the development of the airbag.
Author: Jeremy Blatter

Title: Psychology and the Street: Hugo Münsterberg, Harold Burtt, and the 1914 Joint Street Lighting Committee

Abstract: By the first decade of the twentieth century, electrification had transformed life under the night sky. The dim yellow flicker of gas street lamps gave way to the overpowering white light of electric arcs and the constant glow of incandescent filaments. In an effort to standardize this rapidly changing and expanding street lighting infrastructure, the National Electric Light Association (NELA) and Association of Edison Illuminating Companies formed the Joint Street Lighting Committee (JSLC) in 1914. Although led by electrical engineering luminaries like John W. Lieb, Jr. and Charles Proteus Steinmetz, the JSLC soon realized the limitations of their methods with respect to understanding the effect of illumination on the human mind, not just the physical environment. To overcome this technical deficit Harvard psychologist Hugo Münsterberg was recruited to the advisory committee and his student, Harold E. Burtt, hired to the research staff. Under Münsterberg’s supervision, Burtt would spend the summer of 1914 on Intervale Avenue in the Bronx running a battery of psychological tests under various experimental street lighting conditions. In this paper I explore the dynamic interaction between psychologists and illuminating engineers in their pioneer efforts to experimentally determine the safest, most efficient, and aesthetically pleasing street lighting design. Moreover, as Burtt’s street lighting research was continued in the Harvard Psychological Laboratory, this episode allows for a uniquely close examination of the changing laboratory-field relationship in early experimental and applied psychology before World War I.

Author: Daniela Bleichmar

Title: America in Print, Print in America

Abstract: This paper examines the trans-Atlantic role of prints and print in producing and circulating knowledge about the Americas and in the Americas during the second half of the sixteenth century. It focuses on questions of discovery/invention/innovation and copy/replication related to two case studies (1) Johannes Stradanus' engraving Vespucci Discovers America, interpreted within the context of the Nova Reperta series in which it appeared; and (2) the uses of prints to produce artistic and religious knowledge in sixteenth-century Spanish America.

Author: Victor Boantza

Title: From Philosophical Observer to Active Experimenter: Jean Senebier and the Transformations of the Chemical Study of Light

Abstract: Swiss naturalist Jean Senebier (1742–1809) is best remembered for his contributions to plant physiology, especially his explication of the mechanism of photosynthesis that combined the findings of Joseph Priestley and Jan Ingenhousz with the new discoveries of the Chemical Revolution of the 1780s and 1790s. A careful consideration of the evolution of Senebier’s work on plant growth and nutrition—going back to the early 1770 and the background to his methodological statements on natural history—reveals a richer picture. Influenced by Charles Bonnet and René-Antoine de Réaumur, Senebier advanced in his 'L’Art d’observer' (1775) a philosophy of natural history ('histoire naturelle') centered on the economy of nature and the interrelations between its parts. In a series of memoirs, published in the late 1770s, Senebier reframed these ideas along natural philosophical ('la physique') lines by linking them to contemporary aspects of phlogiston theory, developed by chemists like P.-J. Macquer and A. Baumé. Following this shift Senebier turned his attention to the chemical role of light, thus proceeding to develop an elaborate experimental program ('physique expérimentale') for studying the influence of light on matter, including plants. By tracing these conceptual and practical shifts the paper will shed light on central themes in eighteenth-century science, like natural history vs. natural philosophy, the physical vs. chemical nature of light, the tensions between observation and intervention in the study of nature, as well as the changing relations between the collector, combiner, and manipulator of “facts”—or the historian, natural philosopher and experimenter, respectively.

Author: Stephen Bocking

Title: Environmental Health and the Science of Industrial Salmon

Abstract: The formation of the salmon aquaculture industry over the last four decades has been accompanied by considerable scientific research. This paper applies a transnational (Norway, Scotland, Ireland, and Canada) comparative perspective to the history of this industry and its associated research. From an initial focus on technological development and production efficiency, research has shifted more recently to studies of the industry's environmental implications. This shift
has paralleled a series of environmental controversies involving the industry; this history thus exhibits the often-noted ties between scientific activity, environmental change, and environmental politics. But of special interest is how this history of science, the environment, and politics exhibits evolving conceptions of health. In particular, studies of salmon parasitology have shifted from an initial focus on the health of individual salmon, to instead encompass entire salmon farms, and ultimately, the regional ecosystems in which salmon farms are embedded. Health is therefore demonstrated to be a flexible, evolving term, rooted in conceptions of the biological boundaries between salmon and their environment, and in societal notions of the appropriate roles of salmon and the aquaculture industry in regional marine environments. This history thus provides an interesting counterpoint to other studies of evolving conceptions of health in relation to regional landscapes and industrial environments.

Author: Mark Borrello

Title: Evolving Individuals: A Historian’s Account of an Empirical Investigation

Abstract: Complex multicellular organisms are thought to have evolved some twenty five times in the last 3.5 billion years. This might lead one to think that it’s a rather rare occurrence and perhaps exceedingly slow process. In 2010 my colleagues Will Ratcliff and Mike Travisano evolved a multicellular organism from a single celled species of yeast. An astounding empirical result in need of context. In this paper I will discuss the role of history in our project. Can historians and scientists collaborate effectively? I’ll argue that we can and that these collaborations present great opportunities both in terms of research and pedagogy.

Author: Alexander Boxer

Title: Hans Holbein and the Renaissance Technology of Perspective

Abstract: The same techniques devised for drafting in linear perspective also allowed Renaissance artists to experiment with various types of skewed perspective. Anamorphic projection, for example, so distorts an image that it cannot be resolved except when viewed from an off-center vantage point. By virtue of this visual instability, anamorphoses allowed artists to toy with the conceit of overt and covert ways of seeing. One famous example is the anamorphic skull in Hans Holbein’s 1533 painting “The Ambassadors”. The painting depicts the French ambassador to the English court, along with a friend, both of whom are surrounded by objects of wealth and erudition. It is only when the viewer stands far to the right that the white blob at the bottom of the painting resolves itself into a skull, a memento mori, thereby changing the narrative force of the portrait entirely. Surprisingly, there is no definitive opinion about where the proper vantage point is to view the anamorphic skull. In this paper, we present the results of a computer-based image analysis to answer that question. We develop a strong circumstantial argument that the anamorphic skull was drafted according to a simple geometrical scheme which is attested as early as 1540 and described in detail in seventeenth century optical treatises. We reconstruct this technique precisely, invert it and thereby obtain an optimal location for viewing the skull. This result helps to clarify which technologies were known and utilized by Renaissance practitioners of perspective.

Author: Angie Boyce

Title: Surveilling Salmonella: The Infrastructure of Foodborne Disease Outbreak Detection in Mid-Twentieth-Century America

Abstract: Focusing on infrastructure offers historians a useful method for understanding large-scale transformations in the medical marketplace. This paper uses the lens of infrastructure to examine how foodborne disease, and more specifically, the “ubiquitous” microbe Salmonella, came to be seen as a US public health problem of national importance and surveilled on a national level during the mid-20th century. Increases in industrialized production and mass distribution have fundamentally shaped the evolution of different public health threats in foodborne disease. Perceptibility of these threats relied upon the building of complex infrastructure beyond and within America’s federalist public health system. In the 1930s, the standardization of Salmonella typing nomenclature was a global effort, and in subsequent years, typing centers were established all over the world. Increased capacity for serotype-based surveillance of Salmonella developed during and after World War II provided the building blocks for seeing disease at a national-scale. But it was the fragmented detection of two major outbreaks in processed foods during the 1950s and 1960s that stimulated support for the development of an official US Salmonella surveillance program, bringing to the fore questions about the safety of America’s food supply, the vulnerability of its consumer-citizens, and the role of government as protector. By focusing on these developments, I call attention to the importance of understanding the mediating role of historically-specific detection systems which make disease visible in certain ways, as well as taking into account the intertwined relationships between the clinic, public health, food, and regulatory systems.
Author: Eric Boyle

Title: Archivist, National Museum of Health and Medicine

Abstract: The chemotherapeutic revolution in the post-war United States resulted in a flood of effective new “wonder drugs” for consumers that radically transformed the structure of the medical marketplace. Many drugs that had been successfully sold as proprietary formulas became outmoded by new prescription medications. Pharmaceutical manufacturers also began to enter the self-medication field and the earlier distinction between ethical drugs and secret proprietary on the one hand, and between prescription drugs and self-medication on the other, began to break down as firms diversified and pharmaceutical and proprietary companies merged into large firms making and marketing drug products of all types. These changes created challenges for an informal network of medical reformers who had struggled for years to protect consumers and rationalize the medical marketplace by targeting and combating a range of proprietary drugs and secret formula nostrums they defined as medical quackery. While many in the anti-quackery network struggled to keep pace with the rapidly changing medical marketplace, those pilloried as quacks adapted. Alleged quacks responded to the therapeutic promises of so-called wonder drugs by making their own bold claims for new discoveries and panaceas, exploiting grey areas of medical expertise and highlighting the potential dangers of new pharmaceutical drugs. Ultimately, this meant regulatory institutions and other members of the anti-quackery surveillance network could not keep pace with changes in the medical marketplace. While biomedicine bore the fruits of the chemotherapeutic revolution, quackery, as its most vociferous opponents defined it, remained as big a problem as ever.

Author: Ronald Brashear

Title: Director, Library of Chemical History

Abstract: As director of the Othmer Library of Chemical History, Brashear will talk about the range of resources, from ancient to modern, the fellowships, publishing opportunities, and other resources the library offers, the current projects, and recent successes, with special emphasis on the intersection of chemistry, technology and social history

Author: Ramona Braun

Title: Patterns of Pathology: The Graphical Method, Laparoscopy and 'Mechanical Objectivity' in 20c. Gynaecology

Abstract: This paper describes a shift in the images and media used to measure and test infertility in women. 1940s and 50s gynaecology was characterized by a steep rise in the standardization of methods of infertility diagnosis. The most popular device was the insufflator, a machine that attached a gas bottle to a woman's uterus, with tubes registering pressure oscillations. This graphical method can be considered a residue of 19th century ‘mechanical objectivity’ as described by Galison and Daston. Its main feature was the belief in a direct translation of organ features, its pathological traits and normal state, onto the paper drum. When individual researchers started combining the technique with laparoscopy, an optical tube entered the measurement system. Graph peaks were now contrasted with bubbles of air and abdominal tissue was observed through the laparoscope. Certain imaging practices in 20th century medicine are very much influenced by a belief in graphical transcription and optical devices, exhibited in diagnosis, therapy and experiments in the clinic.

Author: Mary Augusta Brazelton

Title: Wartime Networks in the Life Sciences: Immunology and Bacteriology in China, 1937-1949

Abstract: The Second World War fundamentally shaped the development of the biological sciences in China. When Japan invaded eastern China in 1937, the Nationalist government moved its wartime capital to Chongqing, in southwestern Sichuan province. A number of Chinese biological researchers fled with the Nationalists to the southwestern borderlands of the nation. There, a scientific network emerged which spanned unoccupied China. I argue that as a result of wartime imperatives to develop drugs and vaccines for smallpox, cholera, and other diseases, biologists in southwest China began to see themselves as collaborative participants in the emerging fields of modern immunology and bacteriology. Building on the work of Laurence Schneider, Cong Cao, and other historians of Chinese biology, I draw upon extensive archival research in China and Taiwan to trace the rise of a wartime network of biological research that had nodes in the borderland cities of Kunming, Guiyang, Lanzhou, and Chongqing. I articulate the means by which these cities became centres of calculation that connected researchers in new configurations and produced new knowledge about the life sciences. Biological experts in these
cities improvised methods for making vaccines, developed new collaborations with European and American colleagues, and became the first to domestically manufacture penicillin in China. I argue that the war thus facilitated the emergence of immunology and bacteriology in modern China as distinct fields of biology, constituting a critical step in the evolution of the Chinese life sciences.

Author: Sarah Bridger

Title: Vietnam Radicals and Star Wars Critics: Scientists, Activism, and the Problem of Professional Neutrality in the Late Cold War

Abstract: In the late 1960s, at the height of the Vietnam War, the American Physical Society and other professional organizations faced internal movements to democratize decision-making and to allow for official political statements. A young generation of activists called into question the notion of professional and academic neutrality, given researchers’ deep dependence on Defense Department contracts and the potential military applications of much scientific research. These debates pitted a youthful contingent of New Left scientists against their more conservative mentors, with many sympathetic Manhattan Project veterans caught awkwardly in the crossfire. By the 1980s, however, unified opposition to the Strategic Defense Initiative had begun to heal old wounds. The professional organizations that in 1969 had fought tooth and nail to avoid public denunciations of the war in Vietnam now leaped headfirst into the political battles over Star Wars. The APS commissioned a study of “directed energy weapons” that ultimately condemned SDI as unfeasible. Thousands of scientists—and their home academic institutions—demonstrated their opposition through petitions, mass media appeals, and a highly publicized campaign to boycott SDI-related research contracts. This paper compares scientists’ activism during the Vietnam era to the anti-SDI protests of the Reagan years, arguing that several factors contributed to the inter-generational reconciliation of the 1980s: the growing acceptance of certain New Left structural critiques, the dismantling of traditional channels of government science advising, and the broad nature of the SDI opposition itself; which welcomed moral, technical, and political critiques.

Author: Paul Brinkman

Title: Red Deer Shakedown: A History of the Captain Marshall Field Paleontological Expedition to Alberta, 1922

Abstract: A Field Museum of Natural History expedition to collect Late Cretaceous dinosaurs operated for three and a half months in the summer of 1922 in the Red Deer River badlands (Oldman and Dinosaur Park formations, Belly River Group) of southern Alberta, Canada. Associate Curator of Vertebrate Paleontology Elmer S. Riggs led the expedition. He was ably assisted by veteran collectors George F. Sternberg and John B. Abbott. A trio of novice collectors, Anthony Dombrosky, George Bedford and C. Harold Riggs, Elmer’s youngest son, rounded out the party. The expedition was a success, netting several quality specimens of duckbilled dinosaurs; one small, partial theropod skeleton; an unidentified duckbilled dinosaur skull; four turtles; other miscellaneous fossil vertebrate remains; numerous fossil plants and invertebrates; and a large fossil log. In 1956, one of these specimens – a nearly complete lambeosaurine hadrosaur reconstructed as Lambeosaurus – debuted as the less fortunate partner of Gorgosaurus in the museum’s iconic “Dinosaurs, Predator and Prey” exhibit; Both of these specimens are still on display. Another notable specimen prepared in 1999-2000 after nearly eighty years of neglect has been identified as a juvenile Gorgosaurus and is currently touring the globe. The expedition was an invaluable shakedown experience for the fossil hunting crew and their new equipment in the months before they left on an ambitious, multi-year fossil mammal collecting expedition to Argentina and Bolivia. Finally, American-led dinosaur-hunting expeditions caused an uproar in Alberta, where some locals were very vocal about protecting Canadian fossils from export.

Author: Darryl Brock

Title: American Imperial Expeditions: The Scientific Survey of Puerto Rico

Abstract: As the first decade of the new century ended, the legacy of the Spanish-American War era had driven an American need to display and advance a New World imperial project. The New York Academy of Sciences, in close concert with the city’s American Museum of Natural History, and also the New York Botanical Garden, adopted a plan in 1912 entitled the “Scientific Survey of Porto Rico and the Virgin Islands.” This followed on a tradition of thirty-one research expeditions to Puerto Rico during the period 1772-1889. Puerto Rican natural history expeditions followed the tradition of the Beagle in South America, assessing evolutionary implications for interpreting the biota. The New York expeditionary sponsors envisioned an ambitious twentieth-century metropolitan variant of colonial science to conquer the new scientific frontier of Puerto Rico. Swarms of expeditionary scientists would catalog the plants, animals, geology and archeology of Puerto Rico—
while building on Darwin’s evolutionary context for Caribbean explorations. The New York Botanical Garden, in particular, would now step up to serve the nation by compiling the floras of empire—employing botanical stations and expeditions—much as Kew Garden’s global network had done for the British. The Scientific Survey of Puerto Rico would comprise sixteen scientific expeditions during the years leading to 1933. Orchestrated by the city’s scientific elite, it was funded by the Wall Street elite—the Carnegies, the Rockefellers, and the Vanderbilts. Originally envisioned as a five year project, the Survey published results until 1960, eventually compiling nineteen multi-disciplinary research volumes.

Author: Julie K. Brown

Title: Exhibiting Health for the Public: Museum Challenges in the 1920s

Abstract: To fill the vacuum of information on human biology and the health sciences after the events of World War, efforts were made for a permanent national exhibition and museum presence. These efforts were further intensified with the closure in 1922 of the collections and exhibitions the American Museum of Natural History’s curatorial Department of Public Health. In response, the Smithsonian Institution U.S. National Museum (USNM) opened its “Hall of Health” in 1923 to address the broader issue of the public’s health, specifically in hygiene and sanitation. This paper will trace the background to this situation and the intense public lobbying efforts by the National Committee on Exhibitions of the National Health Council. Specific attention will be made to the work of James R. Tobey as part of this collaborative effort. It will also discuss the installation of a series of permanent displays contributed by outside individuals, organizations, and government agencies to the “Hall of Health” and what distinguished them from more traditional museum and collecting procedures. It will also consider the ongoing efforts by USNM Curator Charles Whitebread to sustain institutional interest in the human biological sciences in face of competition from other Smithsonian science departments. Much still remains to be learned about the museum story in relation to how the public learned about science, the successes and failures of exhibitions, negotiations among specialized staff, public and private patronage, and the diversity of museum audiences. This paper is intended to contribute to this ongoing conversation.

Author: Joeri Bruyninckx

Title: Scientific Scores: Sonic skills, Diagrams and Field Work in Ornithology (1880-1930)

Abstract: Ornithology transformed into a professional discipline of biology in the period between the late nineteenth century and the first half of the twentieth century. This multifaceted shift included not only conceptual renewal and disciplinary redefinition, but also an attempt to standardize methodology. Moving from faunistics to the study of behavior and ecology of living animals raised concerns with what exactly constituted valid observations, especially if they did not only rely on sight, but also on hearing. By the turn of the twentieth century, bird-watchers, naturalists and professional field ornithologists had become increasingly interested in the problem of bird song, and attempted to standardize the ways in which these could be recorded. Between 1880 and 1930, they appropriated musical scores and developed new graphical schemes in their field work, and debated the possibility of a scientific way of listening and the need for a musical ear. This paper traces these attempts to reconfigure listening into an observational technique. It argues that these attempts at ornithological listening took shape between on the one hand, efforts to standardize and transfer embodied techniques, and on the other hand, the need to accommodate a rich multiplicity of interests, competencies and local interpretations. As such, it traces the various functions that sound recordings had in forging an emerging community of field observers.

Author: Robert Bud

Title: History of Science as Tales Told to Promote Visions of the Future

Abstract: In this paper I will explore methods of of analysing shared memory and history in the public sphere, as used by politicians, familiar in popular books and demanded of museums. The paper will reflect on the use of the valuable but little-exploited Begriffsgeschichte developed by the German post-war historian Reinhart Koselleck to help interpret the deployment of the history of science. The uses of the exemplary allegorical story will also be illuminated by reference to the work of Kenneth Burke the Harvard scholar who described his method as “dramatism”, and the switch between registers through the work of Mikhail Mikhailovich Bakhtin. I will use the case study of presentations of applied science between the world wars, the source of much history familiar today, however this will at heart a methodological treatise.

Author: Shawn Bullock

Title: The Pedagogical Use of Models in Late-Victorian Era Physics
Abstract: Although there has been considerable discussion about the use of mechanical models by Maxwellian physicists in the Victorian England for research purposes, there has been less attention paid to the pedagogical relevance of their mechanical models. In this paper I will analyze lectures given by Oliver Lodge as a case study of the pedagogical implications of using models to teach Maxwellian ideas. Lodge seems to have taken the pedagogical use of models the furthest, particularly in his popular lectures on Maxwellian theory. Lodge’s pedagogical abilities are highlighted both in the ways his lecture is constructed and in his choice of models for demonstrations. He begins, for example, by crafting a simple analogy between the flow of water and the flow of electricity and thus making the audience comfortable with the idea of describing electricity and light by virtue of their properties and behaviours, rather than their essence. Lodge wisely prepared his audience for his mechanical models of the periodic motion of light waves and the motion of electricity in a conductor by using several quick demonstrations designed to engage their prior assumptions. The paper will analyze Lodge’s approach using both the pedagogical theory of the Victorian era and current thinking in science pedagogy. Lev Vygotsky’s theory of social constructivism will serve as a particularly revealing lens with which to understand the pedagogical implications of Lodge’s approach because of its attention to the individual, social, and cultural-historical aspects of learning.

Author: James Burnes

Title: From Peale to Piltdown Artists, Amateurs, and Agendas in Science

Abstract: Vertebrate paleontology has been on display since the first fossilized bone was pulled from the earth. The self-correcting nature of science is slow to come to some modern exhibits and outdated models or theories remain on display long after the science has abandoned such archaic models. One cannot forget that these displays were products of their times and once at the forefront of scientific knowledge as it unfolded. In the earliest days, and throughout the century that followed, these constructions served a specific purpose, whether it was to educate, astound, or even legitimize a certain claim. Within the emerging discipline Charles Peale uncovered a monster, Albert Koch assembled one, and Dawson and company created and promoted one. Some of these creations were used to make money, some were the result of hastily attempting to name a new species, others were simply mistakes, and all advanced the sciences in one manner or another. Colleagues and other scientists corrected mistakes, explained the exceptional, and revealed the forgeries. Even though the mistakes were corrected, understanding their original reconstruction, exploring their existence, creation, and history reveal much about the early nature of vertebrate paleontology and vertebrate paleontologists. The collaboration between early paleontologists set the discipline on the path to exemplify how science corrects its own mistakes even if some of those mistakes remain on display long after the scientific community has put them to rest.

Author: Michael Bycroft

Title: Charles Dufay's Systematic Experimental History of Gems

Abstract: To do systematic experimental history is to carry out the same experimental operation on each item in a collection of plants, animals or minerals. This important early modern practice may be illustrated by the systematic experimental history of gems of Charles Dufay (1698-1739). Dufay is known to historians as the teacher of Jean-Antoine Nollet, one of the most famous practitioners of experimental physics in Europe in his day. Dufay is also known as the director of the Jardin du Roi, one of most important sites of natural history in France in the eighteenth century. These two strands of Dufay's career came together in his studies of precious and semi-precious stones. Dufay was a keen collector who used his wealth and connections to acquire many samples of marble, agate, rock crystal, emerald, diamond, and other pricey minerals. He was a node in a network that included the naturalists René Réaumur and Hans Sloane, the writer Antoine-Joseph Dezallier d'Argenville, the auctioneer Edme-François Gersaint, and other key players in French natural history in the period. Dufay deployed his gems in experiments on electricity, phosphorescence, double refraction, and the artificial coloration of stones. He used his collection to discover new phenomena, generalise known phenomena, and discern new laws. His systematic experimental history of gems is a vivid instance of one way in which French experimenters married natural history and natural philosophy in the eighteenth century.

Author: Andy Byford

Title: “Reflexology” and “Pedology” as Scientific Movements: V. M. Bekhterev in Russian/Soviet Child Science, 1900s-1920s

Abstract: The significance of Russian “reflexology”, namely work on conditioned reflexes by the schools of Ivan Pavlov and Vladimir Bekhterev, has been well documented by historians of science. However, less clearly analyzed is the place of this
tradition in the history of Russian/Soviet child science or “pedology” – a cross-disciplinary and multi-professional movement devoted to bio-psycho-social research into child development and socialization, which saw its heyday in the Soviet 1920s. Bekhterev founded his Pedology Institute, devoted to the study of early human development, already in 1907. However, it was in the mid-1920s USSR that his school of reflexological behaviorism became, for a period, the dominant paradigm in Soviet pedology, backed by the Bolshevik establishment due to its radical materialist reframing of human psychology. Child science, in turn, became an important testing ground for Bekhterev’s idea of developmental reflexology. The proposed paper will chart the rise and fall of Bekhterev’s reflexology in the context of the history of the Russian/Soviet child science movement between the early 1900s and the late 1920s. In particular, it will examine how the esoteric discourse of reflexology was transposed and strategically (mis)translated across the various disciplinary, professional and institutional boundaries of child science, namely those of psychology, education, medicine, political ideology and state administration. It will explore the tensions between, on the one hand, the disciplinary and professional heterogeneity of child science and, on the other, the problematic efforts by those involved in this movement to turn it into an integrated, totalizing enterprise.

Author: Kele Cable

Title: The Mutationism Myth, the Mendelian-Mutationist Synthesis, and the Missing Piece

Abstract: According to a common narrative, the views of early geneticists represent an eclipse of reason, an irrational deviation on the path from Darwin to the present: early geneticists, failing to see how Mendelism provides the missing piece that completes Darwin's theory, rejected natural selection and advocated an implausible yet briefly popular "mutationist" view of evolution as a series of dramatic mutations. Based on the works of Bateson, de Vries, Morgan and Punnett, we present the internalist rationale missing from the Mutationism Story. For early geneticists, embracing the Mendelian theory of discrete inheritance, along with the mutation theory for the origin of hereditary variation, did not entail rejection of selection, but rejection of ideas that are rejected or deeply questioned today, including Darwin's doctrine of natura non facit saltum, his flawed views of heredity and variation, and his conceptualization of "natural selection" as a creative force operating on a blending mass of infinitesimal differences. Before 1920, leading geneticists laid the foundations of a Mendelian-Mutationist Synthesis that represents a clear break from 19th-century views of evolution, and a clear foundation for contemporary orthodoxy. Bateson, Punnett, Morgan and their geneticist colleagues collectively are responsible for correctly conceptualizing allelic selection, a zero-force model of population genetics, and the evolution of a quantitative trait with a discrete hereditary basis, among other fundamental innovations. We suggest that contemporary evolutionary thought may be closer in intent to the Mendelian-Mutationist Synthesis than to the subsequent Modern Synthesis (modern neo-Darwinism).

Author: James Cahill

Title: A Hexagon Shaped World? Cousteau and French Cinema’s Scientific Mission

Abstract: In a review of Cousteau’s undersea documentary “Le Monde du Silence” (1956), André Bazin described the film and its floating studio the Calypso as “approaching the ideal of having access to a site of exhaustive observation that alters neither the appearance nor the significance of the object observed.” Bazin saw the film as a significant advance in cinema, believing it to have dramatically reduced the distance between representation and reality while also revealing new, previously unseen, and highly photogenic phenomena. Exemplifying Cousteau’s imperative “il faut aller voir,” the film displays an array of innovative technologies and techniques dedicated to the production of an immersive aesthetic through its fluid, 360-degree underwater color cinematography, producing a “global” perspective above and below the surface of the ocean in its pursuit of the flows of life. Yet the “The Silent World” was hardly produced by noninterventionist, objective observation. The Calypso’s utopic “site of exhaustive observation” belongs to a very particular world: the coastlines of territories and colonies beginning to vociferously assert their right to independence. The film is suffused with a desire to produce a new, cinematic-specific scientific language of universalism, and a failure to sublimate its colonizing desires. This paper examines the conceptualization of “world” “Le Monde du Silence” envisions, and its resonance with the simultaneous attempts at reinvention and reinscription of the uncertain place of France in a rapidly transforming geopolitical context, revising the French civilizing mission as the French scientific mission.

Author: Luis Campos

Title: Tweets as Sources in the History of Contemporary Science

Abstract: With more than 170 million tweets and counting, all soon to be made publicly available in an arrangement with the Library of Congress, the status of some new kinds of digital information available to the historian is in flux. What does it mean when that which was initially understood to be ephemeral is transformed instead into an archival source that will soon be made available for world consumption? And how can such new sources, whether archived or not, be integrated into our
historical work? In my remarks I will address the relationship of such transformations in “publishing,” and the changes in expectations of privacy and publicity they occasion, with special reference to matters of intellectual property in the emerging field of synthetic biology.

**Author:** Guido Caniglia

**Title:** Social Dominance in Wasp Societies: Anthropomorphic Fallacy or Good Analogy? An Analysis of the Pardi-Deleurance Controversy in European Ethology

**Abstract:** In March 1950, world experts in the field of animal sociology met at the CNRS in Paris to attend the conference Structure et Physiologie des Société Animales. During the meeting, an important controversy exploded between Italian ethologist L. Pardi and French entomologist E.P. Deleurance. The controversy was about the nature of social behaviors in Polistes wasps, an important model organism for the study of social behaviors. Leo Pardi proposed an interpretative framework that pivoted around the idea of Social Dominance. According to Pardi, Social Dominance was the mechanism that regulates the organization of wasp colonies. In his intervention, E.P. Deleurance vehemently attacked Pardi’s use of Social Dominance. According to the French entomologist, the category of Social Dominance fits societies of vertebrates but is not appropriate for invertebrates. Pardi’s use of Social Dominance, Deleurance argued, represented an example of anthropomorphic fallacy. Pardi’s analogy, Deleurance further claimed, led him to misinterpret the nature of social behaviors in wasps. As a consequence of the harsh confrontation, Pardi abandoned the field of animal sociology. However, three decades later his ideas became the basis for important research projects in sociobiology. In my talk, I use published articles and archival material to analyze the Pardi-Deleurance controversy. I show that its roots go back to two important, though often neglected, epistemic traditions in ethology: one stemming from French neo-Lamarkianism; the other inspired by Nobel Laureate Karl von Frisch’s work. The two traditions, I argue, radically differ in how they make use of inferential methodologies and analogical reasoning.

**Author:** Nuala Caomhánach

**Title:** Lumpers and Splitters: Methods of classifying the flora of North America

**Abstract:** In nineteenth century United States there was a collaborative effort by botanists to create a single, authoritative account of the flora of North America. George Engelmann (1809-1884), physician and botanist, worked towards this common goal classifying taxonomically difficult plant groups, such as Oaks and Pines. As plant taxonomy was considered as a wholly empirical process completely free of theory, one might presume that Engelmann’s view of nature and his method of classification was that of his collaborators. It was not and with such variation amongst botanists, there was no single framework for understanding relationships in the plant world, particularly between gymnosperms and angiosperms. The approach to classification fell into two broad categories: those who lumped genera together, and those who split genera. This paper will examine Engelmann’s research to gain insight into how botanists understood relationships to organize genera for the Flora of North America project. I argue that the lack of consensus over methodology in taxonomy was an obstacle to the adoption of Darwin's theory of evolution and caused botany to initially lag behind ornithology and zoology in helping us understand evolution.

**Author:** Margaret Carlyle

**Title:** Illustrating Enlightenment Science: Women and Positions of Marginality

**Abstract:** The role of illustrations in Enlightenment science has gained attention in recent historiography. Illustrations served a multitude of functions, as expositions of mathematical formula and physical phenomena; eyewitnesses to marvels of nature, including the inner parts of human bodies or plants; and as pedagogical aide-mémoire. While some illustrations complemented their textual counterparts, others served as book centrepieces that were accompanied by textual descriptions. This paper takes the case study of women engravers and illustrators of science in mid- to late-eighteenth-century France in order to show how their participation in the visual culture of scientific enquiry varied across a breadth of disciplines — from mathematics and physics to botany and anatomy. Using the relatively unknown examples of the botanical illustrator Mlle Basseporte, the natural illustrator Mlle Fonbonne, and the illustrator-engraver team of sisters, Catherine and Elizabeth Haussard, this paper sets out to cast light on the value of illustration within scientific knowledge and women’s multiple and sometimes competing positions of marginality, as assistants of visual knowledge to male producers of textual knowledge. It also considers how artisans versed in engraving and drawing techniques contributed to the formulation of scientific ideas through their representations, and how intellectual and economic negotiations coloured their working relationships with male scientists and academic institutions. The paper concludes by considering the reverse side of the coin, exploring two women,
Mme Thiroux d’Arconville and Mme du Coudray, who enjoyed positions as overseers of the production of engravings and illustrations intended to accompany their respective scientific textbooks.

**Author:** William Carruthers

**Title:** Making Egypt: Archaeological Practice and the Postcolonial State

**Abstract:** As anti-colonial independence movements gained strength in the mid-twentieth century, how were processes relating to the production of knowledge involved? As the history of science moves towards a cross-cultural investigation of the way knowledge is produced, such questions are increasingly relevant. This paper argues that the contested history of archaeological work provides a useful example within this context. Specifically, this paper considers archaeological practices and representations in mid-twentieth century Egypt. Archaeological work is a productive process; its practices can re-shape landscapes, whether physical or intellectual. However, as Egypt moved towards post-colonial independence, what role did these practices play in either shaping or subverting this changing landscape? This paper addresses these issues. To do so, this paper discusses the creation of an archaeological technocracy in Egypt across the period from the 1920s to the 1950s. As British rule waned and the Free Officers eventually came to power, how did the construction of an Egyptian cadre of archaeological practitioners shape political and other possibilities, particularly given that this construction occurred through the mediation of institutions historically tied to colonialism? This paper illustrates how the contested practices related to this process solidified the boundaries of what the (postcolonial) Egyptian nation-state could be, and also how that nation-state’s ancient history could be written about. The gradual construction of an archaeological technocracy as Egypt moved towards postcolonial independence gave meaning to the country’s past, present and future. This paper illustrates how, but also illustrates the late-colonial ambiguities that were central to this process.

**Author:** Cathryn Carson

**Title:** Heidegger on the Scientific Process

**Abstract:** Would it ever make sense to call Heidegger a philosopher of the scientific process? Conventional readings of his work situate him as critical of science from the outside. Taking up a line of argument from newer work in the history of the philosophy of science, I want to insist on approaching Heidegger as a historian would and re-embed his work in practitioners’ philosophy of science of his day. As a student of mathematics and natural science before World War I, Heidegger read Poincaré and Einstein. Trained as a neo-Kantian, he played with the idea of working at the boundary between mathematics and logic. At least up through the end of the 1920s, Natorp, Cassirer, and Husserl were poles in his thinking. So it really should not be surprising that as he tried to rescue Kant from neo-Kantianism and phenomenology from transcendental idealism, the natural sciences provided leading motifs in his framing of how Wissenschaft came to rule. Long before “The Age of the World Picture” and “The Question Concerning Technology,” the scientific process was central to Heidegger’s thought. Reflecting on it was part of his larger effort to get a grip on how Wissenschaft operated, where it was demarcated from other things, and what (else) philosophy might be.

**Author:** Stephen Casper

**Title:** Online Archives and the Illusion of Completeness

**Abstract:** As archives that began in the world of paper move to the digital realm, what happens to the questions that we asked in the physical archive? It used to go without saying that the size of the book, the type of paper, the backs of letters and envelopes, and even the smells of the archive could add texture to our arguments. The archives moreover made myriad details evident: it was often obvious, for example, that someone had selected, organized and culled the record. In short, the material status of the sources and the idiosyncrasies of their preservation informed historical arguments – some of the most significant ones. What of the dust, then, post-digitization? Digitization obviously heralds the transformation of our objects. Yet it is hard to imagine that online archives and exhibits will digitize everything (and still harder to imagine that everything can be digitized). In a few instances, of course, ‘everything’ will be available - a veritable Whig and antiquarian revival for those blessed few illustrious men of science. Meanwhile the ever-more ubiquitous PDF will have been filtered in the most obvious of ways – primary sources will be intended to heighten public interest, show scientists as they were, and cast their lives in a logical and progressive order. In this way, our sources will be more alienated from the daily work of science than ever before and yet ever more derived of a pre-packaged narrative that offers an illusion of completeness.
Author: Anne-Laurence Caudano

Title: “He Who Contemplates the Earth and Makes It Tremble:” Meteorological Phenomena in a Late Byzantine and Slavonic Manual of Natural Philosophy

Abstract: In a brief Late Byzantine manual on natural philosophy, which was probably elaborated in the 14th century, largely diffused in the Byzantine world and translated into Slavonic in the 15th century, a few meteorological sections explain the origin of clouds and various types of rainfalls, thermal springs, earthquakes, thunder and lightning, and shooting stars. While there is an evident Aristotelian background behind the explanations provided in this text, these have been strongly simplified at places and, depending on the versions, embedded into a religious framework. This text offers a strong contrast with what was produced in Byzantine academic milieux, for instance with the works of Michael Psellos, Symeon Seth and Eustratios of Nicaea in the 11th century; or with that of Nicephore Blemmydes (13th century) and Georges Pachymeres (early 14th century). These authors strongly relied on the text of Aristotle’s Meteorologica directly, or on one of his commentators, particularly Olympiodoros and Alexander of Aphrodisias. The analysis of this text shows that it was probably addressed to a “vernacular” audience, in the sense that this text was likely neither aimed at an academic public, nor written by an expert in the field. The simple language and explanations may explain the success of this work in the Slavic world as well. It was indeed, with Basil of Caesarea’s Hexaemeron, one of the rare sources of meteorology for the Slavs.

Author: John Ceccatti

Title: Microbes in the Service of the State: Yeast, Brewing, and German Nationalism before the First World War

Abstract: At the end of the 19th century, new knowledge about the biological nature of yeast and its physiological role in the fermentation process transformed traditional beer brewing practices. In Germany, differences in the adoption of a new technique called “pure yeast culture” to control spoiled beer largely fell along regional – and political – lines. For the most part, brewers and brewing scientists in Bavaria and other southern states readily adopted the new laboratory-based method, while those in Prussia called for another set of techniques based on the craft skill of the brewer. The main proponent of this latter view was Max Delbrück, director of the Experimental and Teaching Station for Brewing in Berlin (and uncle to the future molecular biologist of the same name). In the decade preceding the First World War, Delbrück’s rhetoric concerning the relative merits of traditional and scientific brewing methods was steeped, in part, in nationalistic concerns and an attempt to assert Prussia’s leading role in the German brewing industry.

Author: Xan Chacko

Title: Foreboding Fruit: Ellen Isham Schutt’s Pomological Illustrations of Decay (1911-1915)

Abstract: Rendered for the University of California from 1911 to 1915, before the popularisation of colour photography, the pomological water colour paintings of Ellen Isham Schutt (1873-1955) embody the dichotomy of realism vs. the fabulous or fictional. Originally hired as part of a team of illustrators, by the United States Department of Agriculture (USDA), to create a catalogue of both foreign and domestic fruit varieties, Schutt was poached by the University of California to paint a comparative series on some locally farmed apples, grown and stored under differing conditions, to show a gradation of mould and rot. Intimately linked to the projects of standardisation by the USDA, the paintings served to create and cement the idea of a ‘normal,’ even ‘perfect,’ apple, I argue. By doing a close reading of a few paintings, I complicate the role that these hyperreal images play in the struggle between the empirical and the imaginary. This paper shows how the apple paintings contribute to our understanding of how representation and stability in nature are not only co-constituted but are also co-regulated by functioning as examples of Rheinberger’s “epistemic things”. With colour photography and plant patents, both from the 1930s, the stability of plant species were once again called into question. However Schutt’s paintings came to represent both the ideal types for specific cultivars, as well as optimal conditions for growth, harvest, and storage of apples.

Author: Kevin Chang

Title: Life and Matter in Georg Ernst Stahl's Dissertation De Intestinis

Abstract: The teaching of Georg Ernst Stahl (1659-1734) constituted a new species of vitalism that rejected much of the premise in neo-Platonic vitalism and its derivatives in early modern alchemy. For example, he denied the existence of cosmic spirits that enlivened matter. That was a curious position to take, as his teachers at the University of Jena all shared the alchemical vitalism that was found in the work of Johann Joachim Becher (1635-1682) advocated by Franciscus Sylvius.
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(1614-1672) at Leiden. To study how Stahl's vitalism gradually took shape, it seems imperative to examine his early works, especially his doctoral dissertation De Intestinis (1684). In the early modern practice, the authorship of a doctoral thesis was often shared between the degree candidate and the supervising professor. Thus Stahl's position in his inaugural thesis shows teachings that were shared between Stahl and his professors at Jena and that also served as the point of departure for Stahl's own medical thought. It is in this thesis that Stahl's conception of the soul as a motive agent of corporeal movements first appeared. In this paper I will relate Stahl's position in this thesis to the ideas that he elaborated in the 1690s and 1700s, hopefully to map out the development of the central thesis of his medical teaching. Such work will not only be of significance to the studies on Stahl, but also to the shift from early modern vitalism to the vitalism that dominated Enlightenment medical thinking.

Author: Melissa Charenko

Title: The Historical Debate about End Times and Environmental Action among Evangelical Christians

Abstract: From the 1960s onwards, evangelical Christians have been described as exploitative of the environment. In trying to account for this position, historians have argued that the evangelical eschatological belief in the return of Christ is a central factor limiting evangelical environmental concern. The basic argument suggests that, because evangelicals believe in an immanent rapture of the faithful that will end in the establishment in Christ’s millennial reign, there is no reason to be concerned about the environment. Although the historiography takes this stance to be the standard position among evangelicals, it does not provide any evidence to show that this is what evangelicals actually believed. A close look at the historical evidence seems to suggest that the standard narrative mischaracterizes evangelical end-times environmental positions. In fact, I have found that the evangelical literature is consistently supportive of environmental action in light of the return of Christ and rarely advocates for environmental exploitation because of this end-times belief. By examining evangelical periodicals from the 1960s to the present, I will show that there is a plethora of evidence illustrating that evangelicals do not perceive their eschatological beliefs as being in contradiction with environmental stewardship and that they actually use these beliefs to engage in environmental action. I will also argue that this environmental engagement is not the result of recent developments in evangelical beliefs about either the environment or end-times theology, but is a constantly held view in the evangelical literature.

Author: Gemma Cirac Claveras

Title: From the Ground to Space (and Back Again to the Ground): Some Epistemological Questions on the Fabrication of Satellite Data.

Abstract: Satellite data are often conceded a status of given objects, appearing to us as a faithful representation of nature. Both instruments and processing operations are made invisible. Yet, satellite data need to be actively built (Edwards, Norton, Suppe). POLDER is a radiometer designed by a French laboratory (LOA) and the French Space Agency (CNES) to observe the properties of clouds. Since 2004 POLDER flies on board of Parasol, the third satellite carrying this instrument, and in 1990s airborne observations were undertaken with prototypes. Other instruments are flying in Meteosat, GOES and Aqua, which produce the same type of information. Aircrafts and balloons continue to regularly undertake local field measurements. How all these different datasets come together to produce knowledge on clouds properties? This paper adheres the wider question of how an object is transformed into a blackbox (Latour). My contribution is aimed to shed some light on the question of how we came to know what we know about climate (Edwards, Guillemot). Providing a European perspective I explore how POLDER data is collected, produced, circulated and stored, the dialog between satellite and other data sources, the standardization of calibration procedures, and the closure and validation of data, and how they have evolved over time. From a STS angle, I trace the networks through which data flow along space agencies, research teams and data processing centers, which in turn can help to understand how a peculiar set of relations was engineered among satellite data, other data, and scientific knowledge on climate.

Author: Sanford Clark

Title: Exploring with the Exploratorium

Abstract: The Exploratorium is an innovative and influential Science Museum in San Francisco. Opened in 1969 by Frank Oppenheimer, the museum devoted itself to understanding the natural world through human perception. This pedagogical format differed in focus and immediacy from both the drier, object-oriented, epistemology of the existing science and industrial museums as well as the hands-on experiences of the emerging science centers. In this format, an interest in the sciences is encouraged through direct experience with natural phenomena, often in artistic and aesthetic expression. Recognized by the American Association of Museums with a distinguished service medal in 1982, Oppenheimer’s methods
offer another gateway into the History of Science. Rather than focusing on the artifacts of that history found in the museums, or the ideas and methods illustrated in the science centers, the Exploratorium offers a gateway to this history through direct experience.

**Author:** Philip Clements

**Title:** Science in extremis: Locality and the 1963 American Mount Everest Expedition

**Abstract:** The 1963 American Mt. Everest Expedition sought to place the first American atop Mt. Everest while simultaneously conducting an extensive scientific research program. Mt. Everest’s remote extremity demanded that AMEE employ technologies pioneered for contemporary warfare to maximize the success of these disparate objectives, and, in so doing, the expedition generated novel methods for their use. “Science in extremis” interrogates this confluence of space, technology, and scientific practices during AMEE to argue how the deployment of technology in hostile spaces plays a causal role in the composition, conduct, and conclusions of scientific research, and why this process destabilizes the research norms of scientists operating in these harsh environments. This destabilization leads to the creation of new methods, which, in turn, become norms for future excursions into these spaces. A particular focus is an investigation of local Sherpa porters and other nonprofessional assistants, nylon, down baffling, supplemental oxygen systems, magnetic tape recorders, portable laboratory equipment, and other technologies. For 200 miles, 909 Sherpa porters carried over 55,000 pounds of equipment and food necessary for the expedition’s success. 32 climbing Sherpas and 15 American mountaineers created lines of access up and down the Mt. Everest massif for AMEE’s physiologist, glaciologist, sociologist, and psychologist. All work was done on foot, in an environment that resisted the scientists and their nominal, nonprofessional assistants at each step. Only through on-the-spot innovation of methodology, technology, and logistics, were AMEE’s scientific projects successful in fashioning new norms for scientific research in outer space and the polar regions.

**Author:** Peter Collins

**Title:** The Royal Society and British Foreign Relations

**Abstract:** This paper examines interactions between foreign policy and civil science, and particularly how the Royal Society used scientific exchanges as a medium for maintaining international dialogue in diplomatically straitened circumstances. The Society’s relations with its counterparts in the USSR, China and South Africa will be used to explore the complexities of international science and the intricacies of relations between a national academy and Government.

**Author:** Nathaniel Comfort

**Title:** My Own Private Ishkabibble: Individualizing the Scholarly Community

**Abstract:** For decades—arguably, for centuries—an academic’s professional community has been primarily conditioned by one’s institutional affiliation, professional societies, and journals. Social media can break down these boundaries, facilitating the creation of large, fluid “societies” that span huge swathes of academic, peri-academic, and non-academic professions. My Twitter community, for example, consists of historians, philosophers, scientists, journalists, genetic counselors, biotech executives, and well-read motorcycle mechanics. Such freewheeling interdisciplinarity opens the mind and thickens the skin. The online world favors writers: such a non-captive audience demands natural, non-technical language, compression, and wit. Relevance—whether to current events or classic problems—is prized if not required. Finally, since my community consists of fellow scholars, general readers, and historical actors, this online exchange flattens the conventional hierarchy of primary and secondary sources. In these and other ways, social media challenge cherished notions of expertise at all stages of the scholarly enterprise, from research to peer review. I find this bracing, salutary. We often analyze expertise perceptively in our historical actors, but we do so less frequently in our own profession. Online, no one knows you’re a professor.

**Author:** Sean Cosgrove

**Title:** Sounding Out Social Media

**Abstract:** SoundCloud, a social media website designed to disseminate audio material visualised by a waveform, bills itself as the “world’s leading social sound platform where anyone can create sounds and share them everywhere.” As one would expect, it is populated primarily by amateur music-makers posting their various musical musings and mashups. But can it be a useful tool for historians? SoundCloud represents a space conducive not only to the publication of our aural material—
lectures, seminars, or interviews, for example—with the option of immediate and time-specific feedback, but also an untapped goldmine of (albeit often unwitting) oral histories. Historians cannot, however, passively inject knowledge into the virtual world, ineffective as a means not only of capturing an audience but conveying anything meaningful to them, nor merely accept the biographical productions of anonymous users. As much opportunity as this medium presents, uncritical engagement risks undermining our authority as managers and interpreters of repositories of knowledge, and oversimplifying the complexity of the process of historical analysis and reconstruction. Ultimately—and even moreso than blog projects, Facebook, Twitter, or newcomers like Pinterest—this particular tool and the developing social-media soundscape more broadly remain largely unexplored. While exciting opportunities for new mixed-media histories and additional audio sources abound, maximising the utility and minimising the potential risks posed by this instrument will require further discussion and perhaps, more than that, informed experimentation.

**Author:** Ruth Cowan

**Title:** The NAS in the 1960s: The Rebellion of the Underappreciated Engineers, Physicians and Social Scientists

**Abstract:** The 60s were years of multiple social rebellions in the United States. Interestingly, they were also years of multiple social rebellions within the august and usually conservative halls of the National Academy of Science. Social scientists, engineers and physicians complained of what amounted to taxation without representation: they were considered good enough scientists to serve as volunteers on National Research Council committees, but not good enough scientists to be elected to membership in its sister institution, the Academy. This paper will examine the processes by which these complaints were resolved, leading to the creation of new membership sections, as well as to the National Academy of Engineering (in 1964) and the Institute of Medicine (in 1970).

**Author:** Henry Cowles

**Title:** Reinventing the Whewell: Anglo-American Vocabularies of Method

**Abstract:** Science has always had methods, but "the scientific method" has a history. As I show in this talk, that history is rooted in a nineteenth-century Anglo-American debate over the nature and uses of scientific knowledge. That debate began in the 1830s, when figures like John Herschel and William Whewell began to read seventeenth-century figures like Bacon and Descartes in light of nineteenth-century concerns about "The Decline of Science." As the edifice of "natural philosophy" seemed to fracture into scientific societies and nascent disciplines, these early Victorians reached to "method" as a means of binding things together. My paper traces how this "vocabulary of method" evolved in the ensuing decades, as it crossed the Atlantic and got bound up with American concerns about higher education and the authority of science. Specifically, I focus on a group at the boundary between philosophy, psychology, and the natural sciences—figures like Charles Peirce, William James, and John Dewey—and they used "method" to both articulate disciplinary differences and naturalize the scientific process. As I show, their efforts produced not only American pragmatism but also the modern, singular "scientific method" taught in high schools and trapped in textbooks from the 1920s to today.

**Author:** Nathan Crowe

**Title:** Your Work in One Minute

**Abstract:** n/a

**Author:** Nathan Crowe

**Title:** Your Work in One Minute

**Abstract:** n/a

**Author:** Nathan Crowe

**Title:** Your Work in One Minute
Abstract: In the early 1930s, a time when major figures like Bohr, Einstein, Schroedinger and Heisenberg were intensely occupied with interpreting quantum mechanics, a young doctoral student of Emmy Noether's named Grete Hermann became interested in defending Kantian causality in the face of this new and indeterministic theory. Hermann visited Leipzig in 1934-1935 to study with Heisenberg, her visit culminating in a lengthy essay concerning the natural-philosophical foundations of quantum mechanics which is becoming more widely recognized as one of the first and finest philosophical treatments of the theory. Although the essay is novel in many respects and raises various fascinating questions about Hermann's wider work, Hermann's part in the canonical history—and in particular, her interplay with key members of the so-called ‘Copenhagen interpretation’ at the very time of its inception—remains almost entirely unexplored. The recent discovery by the authors of an earlier, 1933 manuscript written by Hermann on the same topic lends even greater importance to this understudied figure. Not only does the 1933 essay present a striking reversal of views from the later essay, but it also yields a number of deep insights regarding, e.g., Dirac's axiomatic formulation of the theory and its interpretation. In this talk, we describe Hermann's 'lost manuscript' and compare it to the arguments presented in her more mature 1935 thesis. We discuss possible connections between Hermann's thinking and that of Heisenberg, Bohr, Weizsaecker and Dirac, all of whom were aware of Hermann's work at the time.

Author: Alex Csiszar

Title: Counting what Counts: Metrics of Science in the 19th Century

Abstract: What goes into making an object measurable, and what makes it worth measuring? How did science itself come to be seen as such a thing? Nearly a century before scientometricians claimed to found a science of science, scientific advance came to be viewed by some as just the sort of thing that might be quantified. In the 1860s, the Royal Society of London spearheaded a massive catalogue of all 'scientific papers' that had been published since 1800. Although its ostensible purpose had been to provide a tool to help investigators find scientific information, a main use turned out to be the comparison of the scientific contributions of individuals and even nations. This will to measure and map became even more central to later turn-of-the-century scientific cataloguing projects. But these projects did not simply make possible a task for which there was a long-felt need. Before one could imagine counting scientific papers, the latter had to be perceived as uniform enough to be countable, and to be worth counting at all. The rise of efforts to produce a print canon of original science coincided, I argue, with the new notion that particular kinds of authorship were the central practices that made up scientists’ identities. This practical work of canon formation, moreover, helped bring about new styles of thinking about the nature of science, as it did for instance in the influential philosophical texts of the French mathematician Henri Poincaré, himself an enthusiastic cataloguer.

Author: Julia Damerow

Title: n/a

Abstract: n/a

Author: Nadav Davidovitch

Title: Health and Nation Building: Exploring Zionism and Public Health in Context
Abstract: During the last decades, numerous studies have pointed out the significant role of medicine and public health in shaping national identity formation, as well as in the nation-building process, especially in immigrant nations. Recently, taking the "social history turn" in the history of medicine, I want to challenge Asaf Likhovsky's claim that a new generations of Israeli historians has emerged, whom he describes as “post-post-Zionists.” In this paper I use recent studies in the history of medicine and public health in Palestine/Israel to argue that Likhovsky's prism is too narrow. Recent works in the field of history of medicine and public health in the Israeli context should be understood in a wider context of shifts in general historiography and not only in the narrow local discussion of post-Zionism, revisionism or "post-post Zionism." Israeli historians' choice of topics and their way of analysis should be understood as part of the writing of social history of medicine and public health as it has changed and continue to change in Israel as in other countries. Clearly, these new studies did not emerge in a vacuum and were influenced by current debate on Zionism and post Zionism. However, the main change in framework expressed in such studies, derive from broader processes that are taking place in history of medicine as a discipline, including new areas of research and the new methodologies used by social historians.

Author: Surekha Davies

Title: Mapping Exotic Monsters, 1500-1600

Abstract: Early modern mapmakers grappled with the challenge of how to garner authority for maps of regions that they had not seen for themselves. In no case was the problem as acute as in the case of maps encompassing the whole world. Nevertheless, mapmakers regularly trumpeted their works with such claims as ‘most accurate’, ‘newly described’ and ‘most recent’. Through their iconic illustrations and captions delineating the peoples of the world, mapmakers made both epistemological claims about the proper way to make knowledge about distant peoples, and ontological ones regarding the concept of the human and the boundaries between monster, human and animal. This paper traces responses to two monstrous tropes that appeared frequently on maps of the Americas: the Brazilian cannibal and the Patagonian giant. It shows how the visual code of the map, as interpreted by such authors as Jean de Léry, Thomas Blundeville and Ulisse Aldrovandi, transformed scattered, even anecdotal, ethnographic information in travel accounts into general laws about the inhabitants of particular regions. It argues that 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. Finally, it suggests that the changing iconography of the Patagonian giant c.1525-1580 was symptomatic of prevailing uncertainty about the ontology of the Patagonians, a debate within which the conventions on interpreting map illustration led viewers to perceive the Patagonians as a monstrous people.

Author: Jean De Groot

Title: The Cultural Synergy of Mathematical Knowledge in Magna Graecia

Abstract: This paper addresses how progress in the mathematical description of simple machines in southern Italy in the late 5th century BC played a role in the unity of that colonial culture, while also contributing a leading element to the philosophy of Athens, the intellectual center of the colonizer Greek culture. The paper places the kinematic achievements of the mathematician Archytas of Tarentum in relation to the imaginative use of mechanical design in vases coming from workshops in the same region. As is shown with one example, artists working originally in Italian design later incorporated more Greek elements, in particular scenes from Greek drama. This transition is significant, since theater was itself one of the prime venues for the use of machines to simulate nature or bring about what does not occur in nature. I argue that the power of Greek drama in the colonial setting reflects a social epistemology in which the threshold of difference between device and reality was already low. The region’s Pythagorean school of mathematicoi antedated the Greek colonization of the 5th century BC, so that the belief in mathematics as providing both principles of nature and principles of practice played host to later Greek ideas. The Pythagorean context of homegrown mathematical achievement provided the cultural synergy that carried over into artistic appropriation of machine power and ready acceptance of the reality portrayed by theatrical production. This mindset influenced Aristotle whose ambivalence about the separated mathematics of the “Platonists” bears a Pythagorean stamp.

Author: Ivonne del Valle

Title: Between History and Theory. Knowledge about Water in Colonial Mexico

Abstract: The Spaniards’ arrival in American territories brought about radical changes that are only now beginning to be fully understood. The economic, linguistic, epistemological, religious, and environmental alterations implemented during the colonial period completely transformed, even if unevenly, the life that was possible in the old territories. In relation to water, one of the most venerated elements among pre-Hispanic populations, the changes were dramatic. Due to its importance in
sustaining life in the region, the Mexicas organized at least nine of their 18 ritual months around water, and had many technical and religious specialists dedicated to understanding it and managing it. As is well known, after the conquest, the colonial authorities gradually dried out the water surrounding the island of Tenochtitlan in order to prevent flooding. As it was for the Mexicas, knowledge about water was one of the most pressing necessities for Mexico City’s new inhabitants. Yet, beyond the multiple collaborations aimed at solving very specific problems, there seems to have existed a break between pre-Hispanic and colonial knowledge. In this paper I will analyze historical examples that show how this intellectual and technical exchange between Spaniards and the indigenous population took place. I will also suggest general ways that might be helpful to address the problem of knowledge transfer in an unequal context like that of a colonial setting.

**Author:** William Deringer

**Title:** Value

**Abstract:** One characteristic feature of capitalism is a confidence that market prices reflect, more-or-less accurately, what things are really worth. Particularly optimistic depictions of capitalist exchange, like those articulated by Austrian economist Friedrich Hayek or “efficient markets hypothesis” pioneer Eugene Fama, especially celebrate markets’ ability to process economic information and communicate value through price. Yet capitalism is rife with situations where markets alone, unaided by external judgments, cannot really compute the value of things. For particularly complex, rare, or otherwise hard-to-price goods, the haggling of interested buyers and sellers is not a sufficient mechanism for determining agreeable prices because the knowledge demands on potential participants are too high. In those cases, the very activity of the marketplace becomes reliant upon assessments of value made outside the market, particularly the analysis of experts. The centrality of such extra-market judgments is evident in markets ranging from modern art and vintage Bordeaux to corporate IPOs. Such moments—in which knowledge from outside the market becomes essential for placing a value on market-bound goods—provide promising opportunities for exploring the intersection of science and capitalism. This comment will discuss the historical role scientific and mathematical thinking has played in processes of economic valuation, and how science has thereby made certain kinds of market activity conceivable. Notable examples from historical scholarship include the importance of “mixed mathematics” in assessing the viability of investment “projects” in Newtonian Britain and the role of mathematical models like Black-Scholes in energizing financial derivatives markets in the twentieth century.

**Author:** Brian Dick

**Title:** Atomic Gardens: Radiation-Induced Mutagenesis and Agricultural Improvement

**Abstract:** This paper examines radiation mutation breeding programs in the United States during the post-WWII era. In the late 1940s, the Atomic Energy Commission (AEC) established several radiation research programs to investigate “peaceful applications” of atomic energy. Historians have devoted much attention to uses of radiation in medicine and environmental research, but the AEC’s efforts to improve agriculture have been relatively neglected. Through the 1950s and 1960s, scientists at Brookhaven, Argonne, and Oak Ridge National Laboratories constructed “gamma gardens” and experimented with radiation-induced mutagenesis in plants, including food crops. By artificially increasing genetic variation, mutation breeders sought to improve the chances of selecting cultivars with desirable traits. Many mutant food crops were created in this way, including varieties of alfalfa, barley, rice, and wheat. Seeds were made commercially available, and the crops entered the food supply without opposition or special regulation. The paper concludes with a brief comparison of crops modified in the 1980s by recombinant DNA (rDNA) technology. These later crops were subject to intense regulatory scrutiny, despite the fact that rDNA technology afforded far greater precision and control in genetic engineering than irradiation. By the 1980s, different connotations had become attached to the term “mutation” in the public imagination, along with corollary shifts in perceptions of risk. This historical research and analysis may usefully inform contemporary public debates on the regulation of rDNA technology in agricultural applications.

**Author:** Stephanie Dick

**Title:** "Mathematical Objects in Action": Ontological Entanglements of Mathematics and Computing

**Abstract:** Throughout the second half of the twentieth century, computing practitioners in the United States sought to transport the labor and contents of human cognition into the media of digital computers. Some of the earliest such efforts aimed to program computers to prove mathematical theorems. In service of this project, the objects of mathematics were formally and materially reconstituted according to the constraints and possibilities of digital computing. Here, mathematical objects became entangled with the complex ontology of computing - the latter constituted by multiple abstract and concrete machines, data structures, formal languages, and algorithmic processes. In this talk I explore how mathematical objects became dynamic computable objects. In particular, I will explore two computer programs from the late-1950s that were
designed to prove theorems from the logical treatise Principia Mathematica. The Logic Theory Machine, developed at the RAND Corporation, was designed to prove logical theorems by human-inspired heuristic search. The Program "P", developed at IBM Research Labs, was conversely designed to put in motion ideal logical structures to prove theorems in ways no unaided human would be able. The architects of each program developed new (and quite different) data structures, computing processes, and formalisms with which the work of proof could be executed by their computing machinery. I look at how the objects of logic - especially logical expressions and inferences - were transformed by these automation attempts, advocating for the significance of changing material and formal tools in the ontology of mathematics.

Author: Daron Dierkes

Title: Beneath the Mastodon: Creating the First Comprehensive Flora of North America

Abstract: When Thomas Nuttall wrote The Genera of North American Plants in 1818 he completed the first continental flora of the young United States. Many attempted similar work before him, but each suffered from constraints of experience, facilities, connections, and time. This paper looks at the published and planned American floras before Nuttall’s and examines the shortcomings of each based on the opportunities available to their authors in the period of American history in which they lived. Nuttall’s advantages of having been trained and commissioned, traveling the continent, and entering the London natural history community was a culmination of events made possible by contingency and circumstance. That the impoverished Nuttall could be supplied with a research herbarium, food, and a place to sleep at the Academy of Natural Sciences until his Genera could be completed was the result of the slow accumulation of resources in the intellectual community of Philadelphia and was not previously available. The Genera was a book anticipated by a generation of naturalists. It was what Meriwether Lewis was supposed to have written. It created the platform upon which John Torrey and Asa Gray based their work in the following decades.

Author: Dawn Mooney Digrius

Title: "It's Evolutionary, My Dear Watson: Darwinism and the Carboniferous Flora"

Abstract: The evolutionary paleobotany practiced by Mancunian William Crawford Williamson (1816-1895) initiated new understandings of the Carboniferous flora during the second half of the nineteenth century. Thin sectioning microscopy and Darwinian evolutionary theory radically altered the nature of fossil plant science and reorganized botanical floras as a result. This paper analyzes the role of evolutionary paleobotany introduced by Williamson and the reorganization of taxonomic classification for botany. I argue that the notion of fossil floras takes on new value in the botanical sciences after 1900 as a result. The study of fossil floras amplify understandings of the ecological setting of plant evolution.

Author: William Donahue

Title: Science and History of Science at St. John’s College

Abstract: History of Science is an integral part of the curriculum at St. John’s College, Santa Fe, which has long been known for its “great books” approach to liberal education. The students’ scientific laboratory work is intimately bound up with their study of the history of science, leading to a deeper appreciation of both. This talk will focus on some concrete ways of combining the two that could be transferable to other curricular models.

Author: Kevin Donnelly

Title: The New Intellectual Hierarchy: Mongrelist Sociology in America, 1918-1937

Abstract: In 1926, the American statistician Frank Hankins made a plea to keep alive the doctrine of biological racial difference. Classic hereditarianism was on the defensive after decades of popularity in America and Europe, responding on one side to cultural anthropologists who denied any biological basis for culture and on the other to racial determinists who believed in a strict hierarchy of races. In the bestseller The Racial Basis for Civilization Hankins took issue with the latter group, sharply criticizing a range of theories lumped under the heading of the ‘Nordic Doctrine.’ For Hankins, the fault of the Nordic Doctrine was not the belief in biological race but in exaggeration. Civilization did indeed progress through the medium of race, but it was the mixture of races – the blending of difference – that created the world’s great civilizations. Hankins was perhaps the most important member of small but well-placed group of sociologists, statisticians, and anthropologists who envisioned racial mongrelism as the most quantitatively justified theory of hereditarianism. Though early-twentieth century anthropology has often been credited with overcoming “scientific racism,” this cannot account
entirely for the decline of mongrelism. Why did the mongrelists not last in spite of their relative influence in academia and their reliance on quantitative measurement? Why did their conclusions differ from their European colleagues? Most importantly, why did a theory which was both politically palatable and based on numbers fail in an age of political progressivism and quantitative enthusiasm?

**Author:** Connemara Doran

**Title:** Can the Global Curvature of Space be Empirically Determined?: Mathematical Imaginings, Physical Intuitions, and Constraints of Cosmological Measurement, 1873-1936

**Abstract:** My paper analyzes diffusion among late-19th–early-20th-century mathematicians and astronomers of the idea that the universe might have intrinsic curvature, perhaps empirically measurable. Thought experiments proliferated about how beings in a non-Euclidean world would experience their world’s intrinsic curvature. Provocatively, mathematician and celestial mechanist Henri Poincaré argued in 1891-92 that no experiment utilizing either a hyperbolic or Euclidean metric could distinguish between a hyperbolic versus Euclidean world. Offering the possibility of overcoming this mathematical constraint, Poincaré’s analysis situs developed entirely new concepts and tools to assess topological spaces, but it took decades for other mathematicians to probe them. Poincaré’s meaning was thus lost as it diffused, leading to confusions and conflicting interpretations; as Jeremy Gray explains, Poincaré had changed a cosmological question into a deep and subtle epistemological one. These geometric and topological puzzles became persistent “epistemic objects” within 20th-century physics, cosmology, and philosophy. Understanding these interrelated trajectories of mathematics and astronomy helps historians comprehend how, within weeks of Albert Einstein’s 1915 paper introducing general relativity, Karl Schwarzschild (mathematical astronomer working within cosmogonical celestial mechanics) could produce the first exact solution to Einstein’s field equations, produce the Schwarzschild metric, and advise Einstein regarding cosmological implications. Similarly, astronomer Willem de Sitter published three papers in 1916 introducing cosmological (and topological) requirements for GR, vigorously debating Einstein and stimulating Einstein’s 1917 cosmological extension and their subsequent joint models. I explore how, in the next two decades, practitioners in GR and relativistic cosmology confronted global topological and curvature issues amidst burgeoning observational findings.

**Author:** Sven Dupre

**Title:** Kunckel Translates Neri. Reading Technology in the Seventeenth Century

**Abstract:** There is a long history of writing about technology reaching back to Antiquity. Typically, these writings took the form of recipes. However, while specifically addressing readers how to do something, the readership of technological recipes has been less researched. Who were the readers of such recipes? And how did they read the recipes? Did readers try out recipes? An important evolution in writing about technology was the codification of error. Seemingly new in the seventeenth century is the process of writing how-to, as found in earlier named or anonymous sources, followed by the explicit signal that a recipe does not work and suggestions for ways to change it to make it work. In short, this paper is interested in how writing about technology came to reflect the process of reading. It approaches this issue by looking at the translation which the alchemist Johannes Kunckel made of Antonio Neri’s „L’arte vetraria“ in 1679.

**Author:** Roger Eardley-Pryor

**Title:** Limits and Legacies: The Limited Test Ban Treaty and Global Environmentalism

**Abstract:** This paper argues that the rise of global environmentalism reflects both the greatest legacy and the inherent limitations of the 1963 Limited Test Ban Treaty (LTBT). In the 1960s and early 1970s, the success of the LTBT produced declines in the world nuclear disarmament movement; yet, the same period saw the rise of an organized and scientifically supported global environmental movement. For its early members and methods, environmental activists drew from the nuclear disarmament movement, as with Greenpeace sailing vessels into French and American atomic test zones. Additionally, scientists like Rachel Carson, Barry Commoner, and Paul Ehrlich channeled popular ecological understandings about atomic fallout to inspire more widespread environmental concerns annunciated at the first Earth Day in 1970 and the 1972 UN Stockholm Conference on the Human Environment. However, at Stockholm, several limitations of the LTBT echoed related limitations for global environmentalism. While the LTBT drastically reduced atmospheric fallout, it included only three nations, did not restrict their stockpiles or the development of more powerful weapons, nor did it limit nuclear proliferation to other nations. The 1972 Stockholm Conferences, while a landmark of environmental diplomacy, did not include the Soviet Union nor its allies, ignored influential environmental threats (including nuclear weapons), and did little to halt the spread of ecologically destructive industrialization. Though the LTBT and Stockholm Conference were historical
watersheds for a safer and healthier world, the profusion of nuclear weapons and environmental degradation persists as planetary threats.

**Author:** Matthew Eddy

**Title:** The Page as a Picture: Visualising the Everyday World of Learning

**Abstract:** In 1786 the fiery Scottish engineer and journalist William Playfair published a book that reduced the economic data of the world's largest nations into 'charts'. Many scholars treat these images as the first modern graphs. Yet, rather than concentrating on the uniqueness of his graphs, Playfair stressed that his aim was to 'abbreviate and facilitate the modes of conveying information from one person to another, and from one individual to the many.' In other words, he wanted to visualise information in a manner that was simple and which utilised the graphic 'modes' – the skills and routines – already possessed by his readers. In order to see the clever ubiquity of the visual structure evinced in Playfair’s graphs, I argue that we need to treat the pages of early modern books as pictures that were built from a shared palette of patterns and visual skills that were commonly used to ‘abbreviate’ and ‘facilitate’ information in school textbooks. Taking this developmental observation as a starting point, I identify visual patterns and practices by treating the pages of children’s textbooks and notebooks as informatic maps that were learned through repetitive acts of graphic iteration. By the end of the paper we will see that the everyday world of learning was a distinctly pictorial affair that laid the graphic foundation for Playfair’s innovative visualisations.

**Author:** Noah Efron

**Title:** "Our Country Stands at a Crossroad": Science as a Bridge between East and West in Zionist Ideology

**Abstract:** In the swelter of August, 1960, 120 notables representing forty emerging African and Asian nations, gathered at the Weizmann Institute of Science for a conference on “The Role of Science in the Advancement of New States.” The event was conceived two years earlier by Abba Eban, then Israel’s ambassador to the United States, who had since become President of the Institute and Israel's Minister of Education. “The history of our times,” Eban explained, “will be written largely by the two groups of men who came together for the first time at the Conference —the statesmen of developing nations and the leaders of scientific disciplines.” Israel alone could mediate between these two groups, for Israel alone stands “in simultaneous kinship to the scientists and to the representatives of new states.” Eban's persuasion that Israel could harmonize between West and East, developed counties and developing, scientific cultures and pre-, was an expression of an ideological tradition reaching back to the earliest days of the Zionist movement. This tradition saw Zionists as mediators between East and West. In it, science was prized for bringing the best of Western progress to the underdeveloped East. Still, the ultimate aim was not full Westernization, but bridging the developed, but decadent West with the more vital undeveloped nations of Africa, Asia and the Middle East. This paper will describe this mélange of colonialism, orientalism and ambivalence about Jews' place in Western culture, and its place in the formation of Zionist attitudes towards science and technology.

**Author:** Karin Ekholm

**Title:** Matter Made Flesh: Anatomical Debates over the Material Origins of Fetuses, 1600-1651

**Abstract:** William Harvey coined the term “epigenesis” to describe how animals born of eggs and wombs are formed gradually from uniform matter. Historical studies of this concept in the first half of the seventeenth century have focused on the metaphysical aspects of his theory, in particular on tracing its Aristotelian roots. I argue that in order to understand what he meant by epigenesis we must pay attention to his anatomical investigations, as well as those of his contemporaries. Early modern anatomists disagreed about what materials are supplied at the moment of conception, what part of the egg gives rise to a fetus and what mothers provide via the umbilical cord. Harvey’s dissections led him to reject the traditional view that parents contribute materially to the fetus and to contend that fetuses generate and nourish themselves from undifferentiated matter rather than maternal blood. I examine Harvey’s views in the context of contemporary anatomical debates, in particular the responses by Fabrici ab Aquapendente, Adriaan van den Spiegel and Nathaniel Highmore to the work of the Bolognese anatomist Giulio Cesare Aranzio. I examine how they read each other’s work and the role of experiments and observations in the formulation of their theories about the material origins of fetuses.

**Author:** Murray Ellison
**Title:** Edgar Allan Poe: Narrator of Nineteenth-Century Science

**Abstract:** This workshop will discuss Edgar Allan Poe (1800-49) as one of the most important, yet least considered popularizers of science of the nineteenth-century. However, a re-examination of his popular fiction work reveals that he embedded his works with many of the latest technological trends that were of high interest to the public. Among these are three “Dupin” detective stories, illustrating how the scientific process could be used to solve complex crimes. Arthur Conan Doyle credits him with developing the literary detective genre. H.G. Wells and Jules Verne credit him with developing the science fiction genre. Poe also wrote several essays on emerging scientific topics such as cryptography, conchology, hot air balloon travel, and photography. Scholars understand very little about Poe’s final book, Eureka A Prose Poem. He claimed it was even more significant than Newton’s discovery of gravity. In this work Poe theorized about the origins and future of the Universe. His conclusions anticipated the Big Bang Theory and Einstein’s Theory of Relativity. Poe urged readers not to evaluate this work in his lifetime. To date, most literary and science critics have either ignored this work or underestimated it without conducting a valid evaluation. Some have called it “too literary for science and too scientific for literature.” This workshop will posit that Eureka can be best understood and evaluated in comparison to other influential grand science narratives of the era such as Alexander von Humboldt’s Cosmos and Robert Chambers Vestiges of the Natural History of Creation.

**Author:** James Evans

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**Title:** How Much Science in a History Course? How Much History in a Science Course?

**Abstract:** Students’ understanding of historical developments in the sciences are often compromised by their inability to visualize the phenomena. And higher-order skills, such as the ability to distinguish between experimental results and deductions from a theory, which are important in historical analysis, require cultivation and development. This talk will draw on a growing body of science education research to show that we shouldn’t assume that students come to our courses with these skills already in place. It will also offer examples of ways of incorporating experiments and demonstrations into history of science courses as a way of developing the conceptual background necessary for historical work.

**Author:** Angela Ferarro

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**Title:** Theorizing epigenesis in a time of preexistence (1690-1730)

**Abstract:** According to a classic periodization in the history of science, biological thought as it emerges in France from the end of the 17th century to the middle of the 18th century was strongly committed to the doctrine of the preexistence of germs. Malebranche’s role in disseminating this paradigm, particularly in the milieu of the Académie Royale des Sciences during the years when Fontenelle was its secretary, has been studied (Roger 1993). However, much less has been said about the authors who argued against this doctrine prior to the appearance of the relevant pieces by Maupertuis, Buffon and Diderot. I aim to examine a series of French medical treatises and clandestine manuscripts that theorized epigenesis, between 1690 and 1730, to bring to light the strategies – often quite original – that allowed them to achieve this result. One interesting case is the heterodox readings of Malebranche, which use some of his own doctrines (notably on the physiology of brain traces and the laws of nature) both against preexistence and to defend a mechanist form of epigenesis. Amongst the physicians we find Jean-François Vallade (Idea generalis, 1694), whereas on the free-thinking side one can mention Jean Meslier (Mémoire, prior to 1729). I inquire into the historical worth of the positions defended by these authors as well as into the connections existing between the history of epigenesis and that of materialism in the early modern era.

**Author:** Amy Fisher

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**Title:** n/a

**Abstract:** n/a

**Author:** Gerard Fitzgerald

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**Title:** Bioscience Above the Borderlands: Fred C. Meier, Charles Lindbergh, and the Birth of Aerobiology in the United States 1933-1941

**Abstract:** In the 1930s American agricultural scientists, biologists, engineers and physicians became increasingly interested...
in the study of airborne microbes, spores, and viruses. Growing awareness of the potential economic, environmental, and epidemiological consequences of airborne organismal dispersion patterns for humans, crops, and livestock across the country, if not across the globe, brought together a diverse group of academic, governmental, military and corporate actors to investigate, categorize, and possibly even control the spread of airborne microorganisms. Fred C. Meier, a Harvard trained USDA plant pathologist, was one of the leaders of this fledgling interdisciplinary research program known as aerobiology (air-microbiology) which was part of the borderlands research work being funded by the National Research Council (NRC) and overseen by the National Academy of Sciences (NAS). This paper examines the birth of aerobiology in the United States through an examination of Meier’s collaboration with Colonel Charles Lindberg during Lindbergh’s 1933 Pan American Air Lines transatlantic survey flight. Lindberg’s surprising interest in the biological sciences, his engineering acumen, and perhaps most importantly, his unique access to high performance military and civilian aircraft of all types, gave microbiologists and plant pathologists such as Fred Meier the technological means to sample airborne microbes at high altitudes over large geographic expanses and return them safely to earth for analysis. The various relationships and networks developed by NRC/ NAS sponsored scientists to military and commercial aviation during this time period is an especially interesting aspect of this story.

Author: Maura Flannery

Title: Repurposing Herbaria: New Roles for Plant Specimens in the 21st Century

Abstract: Herbaria, collections of preserved plant specimens, have existed since the 16th century and have always been important in taxonomic studies—and remain so today. However, in the 20th century, as cellular and molecular work came to dominate in biology, herbaria became less pivotal. Many, particularly in educational institutions, were either transferred to other institutions or simply thrown away. By the end of the century, however, there was a renewed interest in these collections as biologists found new uses for them in studies on phylogenetics, environmental change, and biodiversity conservation. This paper reviews how and why this re-imaging of herbaria took place, and what this means for the future of this and other natural history collections. It will include a discussion of how herbarium specimens can now be tested for DNA to discover evolutionary relationships among species and for chemical analyses indicating the conditions of the soil where the plant grew or the presence of insect predators. Loss of biodiversity in a habitat can be measured by comparing the results of recent surveys with those of the past. Evidence of climate change could come, for example, from comparing a specimen in flower collected in April this year, and a herbarium specimen of the same species, also in flower and from the same locale, collected 100 years ago in May. Finally, the digitization of herbarium records is making them available to a host of new users, leading to a re-envisioning of their role in the larger culture.

Author: Thomas Fleischman

Title: "The Garden City Paradise"

Abstract: In the mid-1970s, the German Democratic Republic (GDR) set in motion a set of economic reforms that would fundamentally re-shape the country. Under the leadership of First Secretary Erich Honecker, agricultural development targeted the transformation of countryside into an industrial factory for food production. Paradoxically, this expansion of industrial agriculture simultaneously re-inscribed the necessity of small-scale agrarian subsistence into the planned economy. These traditional spaces of food production—gardens, rural "settlements", and the household production of collective farming—proved surprisingly resilient within the socialist modernity of the GDR. Part of this reason was the deep cultural roots of individual production, put down during the upheaval of the industrial revolution and repeated moments of food scarcity in the first half of the twentieth century. Individual production, however, could not have survived without the direct support of the East German regime. Through subsidies, land reforms, and the construction of a produce purchasing “net,” the East German regime oversaw an expansion of individual production to over 10% of the country’s arable land. By the mid-1980s, with nearly 1 in 3 East Germans participating in this system, the production of food no longer followed a strict urban/rural divide. This “garden paradise” serves as an overlooked aspect of state socialism during the Cold War, and as a curious variant to modern agricultural systems.

Author: Jim Fleming

Title: n/a

Abstract: n/a
Author: Philippe Fontaine

Title: The Committee on the Behavioral Sciences: When Natural Scientists Talk about Society, 1949–1955

Abstract: A well-known example of Chicago’s cross-disciplinary ambitions after the Second World War, the Committee on the Behavioral Sciences has received scant attention in the history of the social sciences. Yet, its significance in the attempts by natural scientists to produce a coherent and systematized discourse on society is undeniable. Involving prominent figures such as psychologist James G. Miller (1916–2002), neurophysiologist Ralph R. Gerard (1900–1974), psychoanalyst Franz Alexander (1891–1964) and mathematical biologist Anatol Rapoport (1911–2007), the Committee aimed at integrating the biological and social sciences. That collective enterprise may have had different meanings to its main protagonists but it expressed a common belief, which played no minor role in keeping them together. This paper pays close attention to the minutes of the committee meetings. It shows that the members to the committee experienced serious difficulty in establishing a common language and spent most of their time attempting to clarify various terms and concepts. Though it is doubtful the committee ever achieved full mutual understanding on the key issues which were repeatedly discussed in its meetings, discussion provided members with an opportunity to familiarize themselves with each other’s scientific backgrounds, practices and jargons. More than a community of discourse, the Committee on the Behavioral Sciences was a collective experience through which a number of researchers came to realize the significance of academic cultural differences and learned ways to accommodate them.

Author: Kristen Frederick-Frost

Title: An Artifact Based Study of Henry Moseley's X-Ray Spectroscopy

Abstract: In December 1913 and April 1914, H.G.J. Moseley, a British physicist, published data that is now famed for being the first experimental evidence for the atomic number as a physical property of the nucleus. Historians and scientists have mainly discussed the importance of this work as a product of intellectual networks and theories. This paper explores Moseley's X-ray spectroscopy through the artifacts and manuscripts now held at the Museum of the History of Science in Oxford. Moseley's publications on the High-Frequency Spectra of the Elements described two experimental setups that enabled him to obtain the data for which is his best known. A historical study of artifacts presents a more nuanced account of his process, including various permutations of his instruments and experimental setups. Moseley's surviving artifacts and manuscripts also permit an investigation of the unpublished rare earth research that he undertook with Georges Urbain in June 1914. Although Moseley presented these results at the 1914 meeting of the British Association for the Advancement of Science in Australia, his entry into the war effort and subsequent death cut short further efforts to disseminate the data. The primary contribution of this paper is the decisive identification of previously unstudied rare earth spectra photographs. These spectra can be used to connect Moseley's instruments, results, and notes on the reduction of rare earth data, providing a rich material resource that is scantly represented in the written record.

Author: Yulia Frumer

Title: Backward Needle: Revisiting the Ontology of Space through Japanese Reversed Compasses

Abstract: If anything is certain, as the folklore says, it is that the sun rises in the East and sets in the West. People have long been aware that the position of the rising sun corresponds to seasonal difference, and more recently to magnetic declination, yet no one would mistake East for West. Geographic directions seem to be embedded in the very nature of the universe- their location no less than an ontological certainty. Looking at historical surveying tools, however, we find compasses that contradict this characterization of the geography of the universe, because their dials were reversed—East replacing West, and vice versa. This paper explores the epistemological and ontological significance of reverse compasses by looking at the history of their use in Japan. Employed in extreme situations, these compasses required the user to perceive space in terms of his own movement, rather than in terms of objective geographical directions. Used by 18th and 19th century Japanese surveyors, they might seem like an early modern relic. Yet they were also found in abundance on Imperial Japanese Navy vessels as recently as the beginning of the 20th century, suggesting that the peculiar perception of space they implied was dictated by a convention that refused to obey the boundary between the early modern and the modern. Moreover, that many compasses included both regular and reversed dials, suggests that users could purposefully alternate their perception of space according to the circumstances, by focusing their gaze on one or another part of the compass.
Author: Jia-Chen Wendy Fu

Title: The Artful Herb: Artemisinin and Chinese Medical Research during the Cultural Revolution

Abstract: During the early 1970s, Project 523—a covert operation launched by the Chinese government and headed by a young Chinese medical researcher by the name of Tu Youyou—discovered what has come to be recognized as the most powerful and effective anti-malarial drug therapy artemisinin to date. Known in Chinese as Qinghaosu and derived from the sweet wormwood (Artemisia annua L.), artemisinin was only one of several hundred Tu and her team of researchers culled from Chinese materia medica and folk remedies and systematically tested in their search for a treatment to chloroquine-resistant malaria. The discovery, or “re-discovery,” of artemisinin has been characterized as a vindication of the medical efficacy of traditional Chinese medicine. This paper will attempt to re-situate the history of the discovery of artemisinin within a broader temporal framework in order to understand the larger development of Chinese biomedical science during the twentieth century and the importance of this and earlier episodes of anti-malarial research to our understanding of the conceptualization of medicine in China.

Author: Isabel Gabel

Title: History, Heredity, Event: Raymond Aron, Georges Canguilhem and an Epistemology of Biology

Abstract: The category of organic life, or life understood biologically, took on important new valences in post-WWII continental philosophy. This paper explores the impact of the 1953 discovery of the structure DNA on this broader trend in the history of European thought. Drawing on published and archival sources, I trace how two influential philosophers incorporated this discovery into their philosophies of the living. Hans Jonas had turned to biology in the wake of his break from his teacher, Martin Heidegger. For Jonas, biology had the potential to take the innovations of existential phenomenology and ground them in an ethics by treating metabolism as the universal expression of a desire for existence. For the French philosopher Georges Canguilhem, biology served a slightly different role. Trained as a medical doctor, Canguilhem articulated a biological epistemology that was simultaneously a defense of the primacy of individuality and an attack on materialist understandings of organic life. I argue that where Jonas and Canguilhem diverge can help us to locate an important fault line in the history of continental philosophy, one that later becomes blurred as DNA emerges as the unquestioned essence of life itself. Furthermore, I suggest that only by getting around conventions that treat science as a kind of “cultural context” can intellectual history create a meaningful dialogue with the history of science.

Author: Katharina Galor

Title: Archaeological Practice in Jerusalem: Ideology and Nationalism

Abstract: Jerusalem’s Historic Basin (the Old City and surrounding area) is one of the most intensely excavated and thoroughly researched places in the world and one of the most historically and culturally complex cities. Over the last 150 years, leading archaeologists under the auspices of major academic institutions have conducted numerous excavations there, by and large following standard professional procedures of fieldwork and research, as well as public education and presentation. At the same time, however, recent and current religious and national conflicts have blurred the lines between past and present and between fact and fiction. The problem can be exemplified by two particularly controversial sites which have recently captured the local and international media attention: the City of David/Silwan and the Temple Mount/Haram al-Sharif. Based on these two case studies, this paper will analyze the ongoing struggle to discover and define the city’s past, to expose its physical and historical legacy, and to advance claims of scientific validity and objectivity against the challenges of religious zeal and political partisanship, the latter both intimately related though not necessarily limited to the ongoing Israeli-Palestinian conflict.

Author: Stefanie Gänger

Title: Inalienable Truths. Indian Informers in Eighteenth-Century Botanical Writings about South American Medicinal Plants

Abstract: The “Indian informer” is an iconic form in eighteenth-century botanical writings about the virtues of American medicinal plants. The testimonies of “indigenous” healers or observations of how the “Indians” identified and collected medicinal plants, how they applied them or prepared compounds, made their appearance almost invariably in the period’s treatises. Creole officials, French travellers, and Spanish botanists alike perpetually felt the necessity of questioning “Indians” because they assumed that their intimacy and direct relationship with their environment made them keepers of absolute truths.
about nature’s toxins and its cures alike. This paper studies narratives about Indian “secrecy” and “betrayal” in accounts of
the passing of medicinal knowledge between “Indians” and Creoles or Europeans – instances of refusal and friction where
men and women declined, were coerced or tricked into sharing their knowledge with outsiders. The paper argues that tropes
about “secrecy” and “betrayal” in botanical writings are a testimony to the authors’ cultural assumptions about the Indians’
knowledge as essentially inalienable and unsalable, tied both to the context and the lives of the people who generated it. Still
today, the giving away of “indigenous knowledge” seemingly goes against the grain of nature: herbal medicine appears to
exist outside of commoditization, in what is ultimately a residuum of the evolutionist dichotomy between Western
universalism and non-Western “localism”. A reflection on the genealogy of “indigenous knowledge”, the paper historicizes a
connection that has often been taken to be self-evident: the association between indigeneity and inalienability in the history of
knowledge and science.

**Author:** Miguel Garcia-Sancho

**Title:** Narratives, Disciplines and the Agency of Biomolecular Techniques; or why Frederick Sanger Shifted from Protein to Nucleic Acid Sequencing (1945-1977)

**Abstract:** In this presentation, I will argue that DNA sequencing, a technique regarded as emerging from molecular biology
and paving the way to genomics, was crucially shaped by the development of protein biochemistry. For this purpose, I will
explore the career of Frederick Sanger, the inventor of the first protein and DNA sequencing techniques (1943-1977). I will
focus on the transition of Sanger’s research interests from protein to nucleic acid sequencing, which started in the late 1950s
and culminated in Sanger’s professional migration from the Department of Biochemistry of Cambridge to the Laboratory of
Molecular Biology (LMB), founded by the UK Medical Research Council in the same city in 1962. My talk will contrast the
accounts of Sanger’s new colleagues at the LMB, especially that of co-discoverer of the double helix of DNA Francis Crick,
with Sanger’s own narrative. Whereas Crick describes Sanger’s move as a disciplinary shift from biochemistry to molecular
biology, Sanger sees his own career as fully integrated in biochemistry. By contrasting these retrospective accounts with
archival evidence – namely Sanger’s laboratory notebooks – I will argue that sequencing cannot be seen as an inert technique
emerging from established disciplines, but as a form of work with its own agency to travel across disciplines and transform
its contested boundaries.

**Author:** Oliver Gaycken

**Title:** Digital Complexity: On the Circulation of Special Effects

**Abstract:** Digital Complexity: On the Circulation of Special Effects One of the most venerable Hollywood institutions is
named the Academy of Motion Picture Arts and Sciences. But science is rarely in the forefront of discussions of the movie
industry, featuring only occasionally and then usually in reductive discussions of whether films have gotten their science
“right.” The confluence of the cultures of science and entertainment nonetheless offer a wide range of topics for
investigation. This paper will consider the transformations within filmmaking as the sciences traditionally associated with
motion-picture industry – optics, photochemistry – have given way to the sciences of digital imaging. This paper will focus on a
certain type of scientific object, the scientific visualization, and its transit between laboratory and special-effects studio. The
history of how these visualization techniques were adopted by the entertainment industry attests to a greater proximity
between the cultures of science and entertainment in the age of digital technologies. In particular, this paper will investigate
“swarming” algorithms, which originated in the study of such complex natural systems as bird flocks and insect swarms, and
which have become a prominent feature of effects-heavy science-fiction and fantasy films.

**Author:** Emily Gephart

**Title:** “A Dreamer and a Painter:” Art and the Psychology of Dreams in Turn-of-the-Century America

**Abstract:** Long before advanced imaging technologies generated complex neurological models of the mind’s unconscious
operations, art was an important vehicle through which the human creative imagination might be visualized and understood.
Identified as “a dreamer as well as a painter” by many critics, few other artists of his generation were associated with the
unconscious so often as Arthur B. Davies (1862-1928). Davies’s art engaged numerous strands of thought surrounding the
development of professional psychology in America. The meaning and interpretation of dreams captivated the viewing public
and art critics alike, even before Sigmund Freud’s only visit to America in 1909. But in the US, Freud’s psychoanalytic
theories about dreams were interwoven with those of other psychologists and philosophers: William James, Havelock Ellis,
Carl Jung and Henri Bergson also made important contributions to this evolving discourse between 1890 and 1917. This
paper examines Davies’s work and critical reception in light of the diverse, occasionally oppositional ways in which
dreaming was understood by various branches of medical science as a fundamentally important unconscious process. In fact,
paintings of dreams such as Davies’s served as an important kind of material evidence demonstrating the mind’s imaginative and perceptual abilities. Davies was singled out as a particularly gifted artist whose perceptual skills were linked to the evolving understanding of the unconscious. In this paper I analyze Davies’s paintings, situating them within their cultural and historical context to provide an enriched appreciation of emergent modern psychological medicine’s important intersections with art.

Author: Slava Gerovitch

Title: ‘Socially and Mathematically, it was a Paradise’: Private Worlds of Soviet Mathematics in the 1970s

Abstract: In the 1970s, Soviet officials and academic administrators subjected the mathematics community to serious constraints, including discriminatory policies in university admissions, hiring, and publishing; severe limitations on foreign travel; conservative university curriculum; and even restricted physical access to research institutions and universities. While some mathematicians actively enforced these policies, others responded by creating a semi-private social infrastructure for mathematical instruction and research. This infrastructure included open seminars on advanced mathematical topics; a network of specialized mathematical high schools; informal educational organizations; “creative” editorial policies, broadening the scope of some mathematical publications; the organization of pure mathematics research groups under the auspices of applied institutions; and the practice of conducting mathematical communications outside of formal institutions – in private apartments, at summer dachas, or during nature walks. This semi-private social infrastructure, in combination with other factors of everyday Soviet life, such as low geographical mobility, flexible work schedules at research institutions, and the high value of personal friendship, created conditions for the emergence of a large, closely knit, and actively interacting mathematical community in Moscow and Leningrad. Talented mathematicians responded to the pressures and constraints of official institutions by creating a parallel infrastructure of concentrated intellectual activity, which cultivated a distinct ethos of detachment from career concerns and of dedication to the sublime world of mathematical thought, which Western visitors regarded as a paradise, “socially and mathematically.” Ironically, this idealistic identity emerged from the interplay of restrictive government policies, local institutional pressures, and the privations of daily Soviet life.

Author: Tina Gianquitto

Title: Amateurs, Professionals, or Citizens: Women Plant Collectors and the Harvard Botanists, 1860-1900

Abstract: Throughout the latter part of the nineteenth century, women plant collectors enthusiastically corresponded with the botanists at Harvard University (Asa Gray, Sereno Watson, and George Davenport). This correspondence helps us to complicate further categories of “amateur” and “professional” in nineteenth-century scientific correspondence networks, and instead of these limiting categories, the correspondence will be considered through the lens of “citizenship.” What does it mean, for instance, for women to be considered “citizens” of the scientific community? The letters provide excellent snapshots of the world of women specimen collectors, especially of those who were paid for their collecting efforts. The correspondence displays the range of botanical activities open to women botanists, and shows them asking university botanists to settle priority disputes, to confirm plant identifications, and to accept specimens for the Harvard herbarium. The letters also demonstrate the professional dimension of plant collecting, as in the letters women negotiate payment for specimens, often indicating the economic hardships that drove them to collecting-for-pay in the first place. Additional archival materials in the Harvard University Herbarium also demonstrate the number of type specimens produced by women collectors, as well as the number of “new” species discovered and named for women collectors.

Author: Yves Gingras

Title: A Bibliometric Analysis of The Diffusion of the 1953 DNA Papers: From Science to History of Science

Abstract: The 1953 DNA structure papers published back-to-back, but especially the first among the trio of papers, by Watson and Crick, had become an iconic paper, being more widely cited than the average paper of the time, on a continuous basis from the very year of its publication and over the period 1953-1970. Its citations also came from a more diverse array of scientific journals. A systematic analysis of the bibliometric data thus shows that Watson and Crick’s paper did in fact have immediate and long term impact if we define “impact” in terms of comparative citations with other papers of the time. The talk will compare the bibliometric data for all three back-to-back DNA structure papers in 1953.
**Author:** Snait B. Glissis

**Title:** Constructing Collectivities by Evolutionizing - Freud and Spencer.

**Abstract:** In the newly emerging discipline of psychology of the middle of the 19th century individuals occupied centre stage. Yet two seminal figures, Herbert Spencer and later on Sigmund Freud, assumed relations of dependency of individuals on (past or present) collectivities in their explanatory mechanisms of selected, problematised, features of individuals. Perhaps unwillingly, they posited collectivities as necessary relational components in the construction and constitution of individuals. The connecting mechanisms were evolutionary, and had explicit Lamarckian features. Furthermore, the deployment of the collectivity was perceived as supplying the grounds for claims of necessity and universality, i.e. for their psychology being a science.

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**Author:** Tal Golan

**Title:** The Scientific Imagination and the Origins of Zionism

**Abstract:** My talk will examine the best-known Zionist Jewish Utopia – Herzl 1902 Altneuland against the background of Western utopian imagination, starting with the famous New Atlantis, published in 1626 by Francis Bacon. Herzl and Bacon shared much in common - both were lawyers by education, proliferated writers by nature, and famed statesmen by destiny. Both early 17th-centuries Christian society and late 19th-century Jewish society saw their religious and social hierarchies coming under increasing pressure, and both Bacon and Herzl devised ambitious plans to salvage their society, and in both cases, science, pure and applied, figured front and central in the restoration project. Finally, both Bacon and Herzl turned to the utopian genre after seeing their political agenda coming to a bitter end. New Atlantis and Altneuland were their last major publication, and contained their final dream in its purest form. New Atlantis has long been recognized as an origin story for modern Western society. But in what sense can we recognize New-Old Land as an origin story for modern Israel?

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**Author:** Benjamin Goldberg

**Title:** Dignity, Natural Theology, and Epigenesis

**Abstract:** In this presentation I argue that epigenesis should be understood in the context of scientific ideas about the dignity, excellence, and perfection of the creatures so constructed—and, in fact, these ideas will lead us right back to theories of matter. I focus especially on William Harvey’s 1651 De generatione animalium and his Lumleian lectures, the Praelectiones anatomie universalis (1616). Harvey argues that epigenesis happens only in those more perfect creatures, and not in lesser creatures such as eels or insects. Thus epigenesis is linked with Harvey’s conception of the chain of being and the hierarchy of organic beings. Further, Harvey argues that the very order of generation by epigenesis (that is, which part comes first, second, and so on) is, in fact, dictated by the ‘dignity and use’ of the parts (Harvey 1651, Ex.45, 123). So dignity is thus explanatory of the order of generation! Indeed, dignity is linked with how Harvey understands necessity and relations thereof in the organic world. It appears that Harvey’s conception of the dignity of the process and product of epigenesis, as well as the dignity of the wise designer who set up such a miraculous process, has anti-materialist implications.

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**Author:** Amanda Jo Goldstein

**Title:** Epigenesis and Milieu in Lamarck and Erasmus Darwin

**Abstract:** Reconstructions of Romantic era debates around the nature of biological life tend to lean heavily on Kant’s working definition of the living organism as an “organized and self-organizing” marked by its supreme independence from external causes. But this Kantian notion of an organism as “both cause and effect of itself” has overshadowed competing accounts of livable form. In this paper I turn to the rival epigenic philosophies of Erasmus Darwin and Jean-Baptiste Lamarck, each of whom understood the stimulating and sculpting impress of material “circumstances” as essential to the formation and maintenance of livable bodies. Darwin’s technical term for the relation between living tissue and environment is “configuration,” and the word is rigorously meant: it denotes processes of shaping—with that accomplish not only embryogenesis but also the transition between physiological and psychological experience in his zoology. For Jean-Baptiste Lamarck, meanwhile, life “does not exist except by an external influence” and morphology is the record of that interactive experience. To be disposed towards life in these biologies, I argue, means receptivity as much as power, and animal life is best understood as an ongoing capacity to make “internal” organs out of “external” pressures and influences, natural and social. Against the present-day expectation that biology “naturalizes” historical effects by passing them off as necessary,
then, I demonstrate just how useful biological discourse could be for describing the way bodies incorporate social and historical force, offering a bridge between Enlightenment materialisms of nature and the coming historical materialism.

**Author:** Graeme Gooday

**Title:** Hearing Aids at the Historical Nexus of Patenting, Prosthetics, Physics and Physiology

**Abstract:** Understanding the development of hearing aids requires perspectives from history of science, medicine, technology, disability and commerce. Just as ophthalmic spectacles have long been prescribed for myopia, assistive amplification devices have been marketed to the myriads of the hard of hearing. For centuries available in the high street independently of clinical intervention, unlike their optical analogue, hearing aids have long been subject to regimes of patenting. The first to patent was the Anglo-German Rein family of prosthetics vendors who began their mass production in London c.1800. I examine the motivations for this in terms of patents as a makers’ protection against piracy; as a vendors’ mark of quality to prospective consumers, and as a user’s hallmark of trustworthiness. More than that, this paper looks at how this culture of acoustically and physiologically informed innovation was reflected in a remarkable historical diversity of patented forms. These ranged from conspicuously luxuriant hearing horns used by the rich to select their audience, to the discreetly diminutive electrical amplifiers that borrowed from late Victorian innovations in telecommunication. I map this phenomenon up the advent of the “Medresco” hearing aid in 1948 that resulted from a collaboration of the UK’s Medical Research Council and Post Office radio engineers. While this National Health Service device competed controversially with commercial suppliers in being distributed free to the poor, it also brought hearing aids into line with the medical orthodoxy of eschewing patents – just as that very orthodoxy was under strain from clinicians’ collaborations with industry.

**Author:** Roy Goodman

**Title:** Librarian and Curator of Printed Materials

**Abstract:** The American Philosophical Society Library is a major national center for research in the history of the sciences, medicine, and technology. Founded in 1743, it houses over 350,000 volumes and bound periodicals, eleven million manuscripts, 250,000 images, and thousands of hours of audio tape. The collection includes first editions of Sir Isaac Newton's Principia, Charles Darwin's Origin of Species, a presentation copy of Thomas Jefferson's Notes on the State of Virginia, the elephant folio of Audubon's Birds of North America (for which the A.P.S. was an original subscriber), as well as a majority of Benjamin Franklin imprints and so on. The library is constantly expanding and offers fellowships in every conceivable area relevant to the HSS membership.

**Author:** Gennady Gorelik

**Title:** Enhanced Needham Question on the birth of the Modern Physics

**Abstract:** To answer the famous Needham Question it is reformulated: What hindered Greek science from making the next step after Archimedes, and why didn’t non-Westerners contribute into the modern physics for at least three centuries? The key distinction of the modern physics from pre-Galilean one is the freedom to invent “illogical” fundamental concept to be verified empirically (Galileo’s vacuum, Newton’s gravity, Maxwell’s field, Planck’s quanta…). The basis of this freedom is the belief that the Universe is governed by nonevident fundamental laws, but that humans are able to discover them relying on “the boldest speculation [to] bridge the gaps between the empirical data” (Einstein). The source of this belief was the biblical worldview of all the founding fathers of the Scientific Revolution. The first indication of such a connection was found by an atheist historian Edgar Zilsel in the origin of the expression “physical law”. The basic biblical beliefs in the lawfulness of the Universe, human freedom, and epistemological optimism became implicit fundamentals, or prejudices, in European, or rather Biblical, civilization for both theists and atheists, and this can explain why the modern physics freely propagated over the Christian countries including backward Russia, but failed to penetrate the invisible borders of the Biblical civilization. The space and time of the Scientific Revolution was determined by the surge of social significance of the Bible due to book printing and Reformation. This explanation is supported by the fact that most inventors of the new fundamental physical concepts were not atheists.

**Author:** Diane Greco Josefowicz

**Title:** Fascinating Lives: Using Scientific Biography

**Abstract:** As a genre, scientific biographies have a distinct advantage over conventional scholarly monographs insofar as
students can engage with them without needing any preliminary initiation into the conventions of scholarly history. Rather, the class learns these conventions gradually, as part of the process of learning to think critically about the limits of the genre. Additionally, thinking about genre limitations encourages students in STEM disciplines to deploy familiar modes of analysis in new, non-scientific domains. Students accustomed to thinking about "units of analysis" and "boundary conditions" in their science classes can easily and confidently apply those modes of thought to scientific biographies when they are encouraged to ask questions like: Why should a single human life be a historian's unit of analysis? What might this "boundary condition" of biographical writing encourage the historian to exclude or de-emphasize? Finally, teachers can help students transform their answers to these questions by encouraging new approaches to their own writing, particularly as they learn to revise by reflecting in similar critical and analytical ways on their own early drafts of assignments.

Author: Jeremy Greene

Title: Ordering the World of Cures: The International Politics of Drug Names

Abstract: In the fall of 1948, René Hazard, architect of the French Codex and unquestioned authority of pharmacy for the Francophone world, posted a series of memos to Geneva to be circulated through the newly-opened offices of the World Health Organization. An earlier attempt by the League of Nations to establish a universal Latin name for all drugs moving in global commerce had clearly failed, he related, due to the increasing structural complexity of modern chemotherapeutics and “the fact that every country selected a different common name designating the same prescription without reference to similar designations made by other countries.” As part of the WHO’s Expert Committee on the Unification of Pharmacopoeia, Hazard called on his colleagues in Geneva and around the world to create a novel, synthetic, universally-recognizable language of therapeutics. In parallel with the WHO’s international classification of disease (ICD) system (which by that point was well underway in ordering the world of human ailments) this Pharmacopoeia Internationalis hoped to speed the progress of global biomedical research and global pharmaceutical commerce by giving each drug one and only one true name. This ideal name would be neither a chemical name (too complex to be useful in practice or commerce), nor a trademarked brand name (too quickly tangled in the morass of international intellectual property law), but a new name: a generic name. The acceptance of this naming project, however, was far from universal. This paper tracks the use of rational language to order the new world of global pharmaceuticals.

Author: Jim Grossman

Title: Scholarly Societies, Research Libraries, and the Broader Landscape

Abstract: Jim Grossman is Executive Director of the American Historical Association and a member of the History Department faculty at the University of Chicago. From 1997-2010, he was Vice President for Research and Education at the Newberry Library. He received his Ph.D. from the University of California, Berkeley, and has taught at the University of Chicago and the University of California, San Diego.

Author: Joel Hagen

Title: History of Biology and the Uses of History in Biology Textbooks

Abstract: Although historical vignettes commonly appear in biology textbooks, they rarely reflect recent scholarship in history of science. My paper explores the history found in biology textbooks from the mid-twentieth century to the present and examines the ways textbook authors have used these historical accounts. I conclude with suggestions for how professional history of science might better inform the use of history in biology textbooks.

Author: Orit Halpern

Title: Test-Bed Urbanism: Cybernetics, Design, and the Territory of Ubiquitous Computing

Abstract: This paper traces the cybernetic influence on designers, urban planners, architects, and human scientists, to produce a preliminary speculative genealogy of contemporary “smart” and ubiquitous computing territories and mediums. Taking a series of case studies ranging from the independent group—Archigram—to Nicholas Negroponte’s experiments in Soft Architecture, to contemporary smart city developments such as Songdo in South Korea, the paper will trace the rise of this ideal of an algorithmically produced territory, and the subsequent transformations (real and imagined) in the forms of measurement and calculation administering populations. Ideals of feedback, data management, modularity, and control underpinned an emerging post-World War II attitude to the city as an experimental “test-bed”, a self-reflexive, and self-
monitoring organism which was infinitely enhanceable, improvable, and mobile. These real and imagined machine-cities were viewed as experiments with no truths to uncover, self-produced reality worlds which by far overcame any discourse of simulation that still relied on the real. Counter, then, to contemporary arguments about simulation and risk, this paper will argue that the cybernetically imagined city possessed a myriad of forms. This is particularly true throughout the 1960’s and 1970’s as worries about nuclear security faded in front of concerns about racial tension, transformations in political economy, and environmentalism. Bridging the utopian, the possible, and the built, this paper inquires into these contested imaginaries and futures of urban, perhaps human, life that came from cybernetic traditions and continue to inform our ideals of smart, sentient, calculative spaces and ubiquitous computing.

Author: Rich Hamerla


Abstract: This paper’s subject is the chemist Edward Morley and how his story demonstrates the way many American scientists of the late nineteenth and early twentieth centuries reconciled a rapidly developing scientific understanding of their world with their need for religion as God became increasingly unnecessary as a means for explaining nature. What we find in Morley is a chemist who uses his scientific acumen to find a place for a divine being in an explanation for the physical characteristics of water in his 1867 article, “Natural Theology: Theory of Heat.” He does this by noting several qualities of water and the way these attributes contribute to man’s, animal’s, and vegetation’s survival in what would be an impossible physical environment were these qualities even slightly different. His is a theistic perspective as he sees an “Author’s” hand maintaining the characteristics necessary for stability, validating “Him” as a compassionate custodian of an otherwise evil and cold world.

Author: Bert Hansen

Title: The Unnoticed Place of Art and Artists in Pasteur’s Scientific Biography

Abstract: This study enriches the standard biography of Louis Pasteur by revealing his overlooked, yet substantial involvement in the social world of artists. Pasteur is usually seen as a dour, rigid, and unsociable workaholic with no interests outside of the laboratory—even neglecting his devoted wife and children at times. Without denying the primary lineaments of the standard picture, this paper explores his enthusiastic personal connections with painters and sculptors and with the internationally significant art exhibitions of the Paris Salon. His engagements with art were far more than chatting with painters while sitting for portraits. On several occasions, he interrupted his normal work day in the laboratory to meet socially with an artist or visit an art exhibition. Just as Pasteur wielded political power in scientific matters, he also used his connections to secure favorable notices of paintings by artists he favored, and he tried to ensure their paintings would be accepted into the Salon with favorable placement in the galleries. Additionally, he often took a more active role in planning portraits than other sitters did, and he commissioned art works for the opening of the Pasteur Institute. His varied engagements with art and artists throughout an inordinately busy and productive career as a scientist have not been documented by scholars. (Research for this paper was begun as a joint project with the late Richard E. Weisberg.)

Author: Penelope Hardy

Title: "Have Lab, Will Travel": Per F. Scholander, the R/V Alpha Helix, and the Ship as Scientific Symbol

Abstract: Research vessels, as twentieth-century oceanographers’ premier technological tool—their own version of “big science”—both allowed and controlled access to the oceans. In the process, these ships enhanced the prestige and power of those scientists, administrators, and institutions that controlled them. In a post-World War II funding environment dominated by the interests of the navy, physical oceanographers generally set the agendas for oceanographic research vessels, leaving biologists to adjust their research accordingly or to stay ashore. Biologists responded to this perceived lack of power by seeking research vessels over which they would have the power to determine both equipage and mission. Several such vessels were built or converted in the 1960s, but Scripps Institution of Oceanography’s R/V Alpha Helix, brainchild of physiologist Per F. Scholander, was the most celebrated—and arguably most successful—of these gambits. As an ocean-going laboratory, Alpha Helix provided biologists with an important research tool dedicated to their own needs. It allowed far more immediate and hands-on production of knowledge by bringing scientists and their laboratories to the scene of their work. Yet as this paper will show, Scholander envisioned more than a scientific instrument; the Alpha Helix would also serve as a social and disciplinary tool to build biological oceanographers into a recognized and recognizable community with control over their own scientific agenda.
**Author**: Roger Hart

**Title**: Tracing Practices: A Microhistorical Approach to World History of Science

**Abstract**: For George Sarton, the history of science was to be hagiographic, celebrating great scientists. During much of the twentieth century, the history of science similarly celebrated an anthropomorphized “West,” which through its science overcame other civilizations in the race to modernity. Against these macrohistories of “civilizations,” this talk proposes a microhistorical approach to world history of science. It presents evidence that esoteric mathematical practices spread across Eurasia—including early imperial China and thirteenth-century Italy—suggesting that the assumption that other mathematical and scientific practices were not similarly transmitted should be reconsidered. We must thus reconsider the relationship between scientific practices, texts, and authorship during this period. Scientific practices of this period often did not depend on texts: their learning, teaching, and transmission did not require literacy; when they were recorded in texts, it was commonly for purposes of patronage or displays of expertise. Instead, extant texts preserve only fragmentary evidence of practices of the period. It makes little sense for historians to grant credit for scientific discoveries to those who, in their pursuit of patronage, sought to claim that credit for themselves. It thus makes even less sense to attribute credit to what we now anachronistically call “China” or “the West” simply on the basis of the earliest known extant text in which a practice is recorded. It is likely that scientific practices circulated following routes by which commerce, art, and religion were transported by traders, missionarides, and travelers, during what is increasingly understood to be the “global Middle Ages.”

**Author**: Emily Hauptmann

**Title**: “Propagandists for the Behavioral Sciences”: The Partnership between the Carnegie Corporation and SSRC at Mid-20th Century

**Abstract**: In 1954, the Reece Committee of the U.S. Congress alleged that the SSRC exercised too much influence over academic life and that it did so at the behest of private philanthropic foundations. Though they later derided the Reece Committee for its overheated anti-Communism and thinly disguised resentment of the educational and philanthropic elite, foundation and SSRC officials were initially thrown onto the defensive. Despite its brief and incomplete investigation, the Reece Committee was on to something in focusing on the “interlocks” between the council and the foundations. In this paper, I pick up one thread of the Reece Committee’s investigation by focusing on the close collaboration between the Carnegie Corporation and the SSRC in the first decade after WW II. I show how this relationship developed after a struggle between Carnegie and the Rockefeller Foundation over the direction and leadership of the SSRC in the late 1930s and early 40s. I then examine how Carnegie helped conceive and fund several postwar projects that defined the SSRC as a major advocate for behavioral social science. Among these were Stouffer et al.’s The American Soldier, election studies conducted by Michigan’s Institute for Social Research and the SSRC’s influential Committee on Political Behavior. I build on my previous work on the Ford Foundation’s support for the behavioral sciences to argue that the Carnegie Corporation, working with and through the SSRC, was an even earlier promoter of the behavioral sciences than Ford and at least equally important to their success.

**Author**: Lisa Haushofer

**Title**: Addition by Subtraction: The Removal of the Spleen in Nineteenth-Century Darmstadt

**Abstract**: The surgical removal of an organ in its entirety has become an accepted and valid therapeutic approach, even a routine procedure. Yet it is far from obvious why this should be the case. To consider an organ removable requires a particular view of the body; to consider organ excision as curative presupposes a particular view of disease. This paper will examine the disagreement following a case of spleen removal performed by the German surgeon Heinrich Küchler in 1855, in a period of great political and professional turbulence in the German-speaking territories. Using medical publications, letters, speeches and society proceedings, the paper will explore how the knowledge of the “removability” of the spleen, and the agreement that particular conditions provided “indications” for spleen removal, were negotiated. Central to the argument is the notion that the variables of the debate were largely determined by a visceral and uneasy relationship between experimental physiology and surgery, in which physiological experiments determined surgical removability, and surgical procedures became physiological experiments. The spleen was envisioned as an organ whose anatomical and physiological dispensability could be read from the bodies of humans and animals. The performance of surgical procedures, in turn, solidified these claims, and contributed to the creation of knowledge about the body. This bodily knowledge informed different conceptions of spleen pathology, which found expression in distinct therapeutic approaches. The anatomical and physiological properties of an organ, a conception of its pathology, and an invitation to surgical intervention, could all be read from the body.
Author: Darin Hayton

Title: Byzantium: The Other East

Abstract: Byzantine science does not fit neatly into our standard histories of science. To the extent that we recognize any Byzantine science, it is neither properly "east" nor properly "medieval." Moreover, Byzantine scholars were not particularly innovative, preferring to comment on Plato an Aristotle in archaic Greek. Beyond preserving various classical texts, they contributed little to the development of science. There are two problems with this easy dismissal of Byzantine science. First, it assumes that scientific knowledge is meaningful only when it contributes to scientific progress. Second, it fails to recognize the importance that premodern scholars themselves attached to Byzantine science. I will argue that we should take Byzantine science more seriously. On the one hand, if we see the production of scientific knowledge as a culturally meaningful activity, Byzantine science is interesting precisely because its relevance does not derive from technical innovation or scientific progress. On the other hand, our understanding of premodern science is enriched when we recognize intellectual commitments of premodern scholars, who expended considerable time, energy, and resources searching for, printing, translating, redacting, and reading Byzantine texts.

Author: Jenna Healey

Title: Time on the Clock: Age-Related Infertility and Reproductive Technologies in Late 20th-Century America

Abstract: When is it too late to have a baby? This question took on unprecedented urgency in the 1980s when a shift towards delayed childbearing threatened to unleash an epidemic of infertility in the United States. Professional women began to fret about the ticking of their “biological clocks”, a metaphor that perfectly captured the complexity of this new reproductive calculus. While traditional medical wisdom held that fertility declined with age, there was no medical consensus on the risks of delaying conception. Was delayed childbearing worth the risk? If so, how could these risks be managed most effectively? To some, the solution was obvious: women should prioritize childbearing over career advancement. But many women refused to compromise, instead turning to the new technology of in-vitro fertilization (IVF) to maximize their chances of conceiving at any age. This paper will examine the transformation of IVF into a technology for managing age-related infertility, arguing that patients themselves were the major catalyst in this transformation. Early IVF clinics, many self-regulated and for-profit, often enforced age-limits based on the assumption that age-related fertility decline would jeopardize the method’s already low success rate. Potential patients challenged these restrictions, even lying about their age in order to gain access. By the end of the 1980s, patient pressure resulted in the expansion or elimination of age limits for IVF and spurred clinics to offer new services such as embryo cryopreservation and egg donation. In the process, IVF was reimagined as a consumer technology for extending reproductive lives.

Author: Benjamin Hellwege

Title: “To serve, and not to be served”: The AARP and the Origins of Medicare, 1958-1965

Abstract: The enactment of Medicare in 1965 has long been seen as a touchstone moment in the evolution of the American welfare state. However, traditional accounts of the story of Medicare’s origins, development, and passage into law have privileged the role of national political figures such as Lyndon Johnson as well as other architects of the Great Society’s social welfare policies. By contrast, the role of older, non-elite Americans as active political agents in shaping the debate around Medicare has been overlooked. This paper examines the role of the American Association of Retired Persons (AARP) during its early, formative years as a lobbying organization for older Americans, which were largely – but not exclusively – dedicated to fighting against the enactment of any sort of publicly-funded national health insurance plan for older Americans. Instead, the AARP, under the guidance of its founder Dr. Ethel Percy Andrus, sought to articulate and realize an ideological vision of an active “modern maturity” in which older Americans would resist perceived economic or social dependence on the larger surrounding community. This paper will examine why the AARP at first sought to block enactment of Medicare and why it later switched its position and became one of Medicare’s biggest proponents. In doing so, the paper will trace the emergence of the AARP as the nation’s premier senior citizens lobbying group, an outcome that was not predestined at the time of its founding.

Author: Evan Helper-Smith

Title: Correspondence, Coordination, and the Colorful Language of Paul Ehrlich
Abstract: The German physician-scientist Paul Ehrlich carried out groundbreaking research at the turn of the 20th century in a number of now-distinct fields, including histology, hematology, immunology, and chemotherapeutics. These lines of research were unified by a shared basis in the biochemistry of synthetic dyestuffs – Ehrlich studied their selective binding to tissues to develop novel stains for blood cells, analogized their chemical specificity to that of toxins and antibodies in his side-chain theory of immunity, and made this analogy literal in his investigations of the antimicrobial properties of dyes. While the conceptual unity of Ehrlich’s project isn’t evident from his voluminous correspondence with physicians, microbiologists, chemists, and chemical industry representatives, its material unity is apparent: Ehrlich constantly made requests, gave thanks, placed orders, issued instructions, asked questions, and reported research about dyestuffs. To do so was far from a trivial matter. The nomenclature of synthetic dyes was notoriously foreboding, full of tongue- (and wrist-) twisting constructions, competing lexical conventions, and a proliferation of synonyms. Ehrlich’s ability to coordinate the many projects in which he took an interest – and to keep them supplied with necessary material – depended on using such names efficiently and reliably to specify the identity of particular chemical species to many different audiences. In this paper, I will argue that in his variegated scientific correspondence, Ehrlich adopted a vocabulary of color in referring to dyestuffs, even as organic chemists sought to eliminate references of chemical names to observable properties, and tie them instead to chemical structure.

Author: Matthew Hersch

Title: Exploration Endangered: Public Science in an Age of Private Spaceflight

Abstract: Forty years after the first landings by America’s Project Apollo astronauts on the surface of the Moon, their now-famous sites of exploration and scientific research face obliteration at the hands of well-meaning adventurers and entrepreneurs. Google, through its Lunar X PRIZE, has offered tens of millions of dollars to private consortia that successfully land robotic vehicles on the lunar surface, and even more money to teams that visit Apollo landing sites. For decades, these pristine sites of exploration—sites of undeniable historical importance and national pride—were protected from damage by their remoteness and the airless environment of the Moon’s surface. They now face destruction, jeopardizing not only cultural treasures, but ongoing scientific experiments in astronomy, geology, and space weathering. At what point must the laboratory of the Moon become a tourist attraction unfit for scientific inquiry? Or can a middle ground be struck between science and exploration? Can the United States hope to act, given the difficulty of protecting land 250,000 miles away from the nearest government employee? A PowerPoint slide show will accompany this paper.

Author: Mark Hersey

Title: “The Debatable Ground Between”: Agricultural Ecology in the Progressive Era

Abstract: While historians of science have written a number of excellent studies of ecology’s history, they have generally (often deliberately) downplayed its early connections to agriculture. In doing so, they have privileged the ex post facto reality of ecology’s development, neglecting the ways in which many practitioners of the nascent science (indeed, perhaps the majority) construed of their field in ecology’s formative years. As W. G. Waterman noted in 1917 (in the midst of a public debate over the relative merits of agricultural ecology), it was “evident that ecology belongs both to botany and to agriculture, and in fact covers the debatable ground between the two subjects.” This paper, then, seeks to examine the vital connections between agriculture and ecology during the Progressive Era by engaging the ecological research done at land grant schools and experiment stations where botanists, both prominent and obscure, sought to find useful applications for a science still struggling to establish credible theoretical underpinnings. Although few of their proposals gained much traction in agronomic circles, their efforts highlight the ways in which land-grant scientists found themselves betwixt and between, under pressure to find practical applications for their intellectual pursuits. In navigating that predicament they contributed (and fell victim) to an emerging land-grant ethos that would later be decried for “subordinating the real interests” of American agriculture to economic considerations.

Author: Ian Hesketh

Title: Progress and Purpose in the Evolutionary Epic; or The Victorian Origins of "Big History"

Abstract: In the last twenty years, a new form of historiography has made inroads in universities throughout the world known as “big history,” a grand interdisciplinary experiment that seeks to tell the story of human history within the context of the origins of the universe by combining the recent findings of, among other fields, cosmology, geology, biology and, of course, human history. What practitioners fail to realize, however, is that this supposedly novel form of historical writing
actually originated in nineteenth-century Britain under the guise of the “evolutionary epic.” Victorians as diverse as the publisher Robert Chambers and the anthropologist Winwood Reade set out to place human history within a grand progressive narrative that stretched back to the origins of the universe in a “hot cloud vibrating in space” up to the birth of human civilization. While versions of the evolutionary epic ranged from the theological, as in Chambers, to the secular, as in Reade, they tended to promote a view of evolution that was progressive and goal-directed, culminating in the story of humanity itself. By exploring the ways in which the evolutionary epic was more properly influenced by a developmental view of life rather than an outright Darwinian one, this paper ultimately seeks to contribute to a larger project on the genealogical origins of “big history”—the origins of which are to be found not in the neo-Darwinian theories of the present but in the developmental narratives of the Victorian period.

Author: Jessie Hewitt

Title: Private Practice: Women and the Family Asylum in Nineteenth-Century France

Abstract: This paper focuses upon a subset of private mental institutions in nineteenth-century Paris that featured a method of treatment called the “family life.” This particular approach to patient care emphasized the curative possibilities of middle-class domestic values and required doctors’ families and their patients to live together as a household. I thus examine the opportunities for feminine self-fashioning that existed in the semi-domestic space of the private institution by drawing upon the writings of a multi-generational family of asylum directors (specifically those of Dr. Alexandre Brierre de Boismont and his daughter, Marie Rivet). Located on the blurry edges of public and private life, family-owned asylums like those owned by the Brierre de Boismonts provided women with opportunities to gain a degree of personal authority, autonomy, and recognition for their intellectual and medical contributions at a time when dominant cultural values proscribed middle-class women's labor. Yet, such women only did so by carefully managing their reputations and by limiting their claims to expert status. Furthermore, despite their own unconventional private and professional lives, women asylum directors often perpetuated rigid gender and family values through their medical practices.

Author: Toshihiro Higuchi


Abstract: On December 3, 1955, the United Nations General Assembly passed a resolution establishing a Scientific Committee on the Effects of Atomic Radiation (UNSCEAR). Fifteen countries from both sides of the Iron Curtain, including the United States, Great Britain, and the Soviet Union, sent their scientists to the committee to review the biological effects of radioactive fallout from explosions of nuclear weapons. Despite its historical significance as one of the first intergovernmental scientific panels concerning the global environment, few studies have discussed this multinational expert body. To challenge the persistent myth of pure knowledge in global environmental politics, this paper will trace how UNSCEAR produced what counted as knowledge. With a focus on the three nuclear powers, it will argue that UNSCEAR constituted a hybrid place where science and diplomacy became seamless. What drove the epistemic negotiations was not a clash of political self-interests and ideological biases, but a paradox born out of the universal faith in science despite the trans-scientific essence of fallout hazards due to its unknown and unknowable elements. Barred from discussing national security that justified all residual risks in fallout, the epistemic negotiators at UNSCEAR were forced to search for an alternative, “value-free” context to make sense of global contamination. The paper will show that this exploration of context within and across the Cold War blocs led to the perfect alignment of science, ethics, and politics for the Soviet scientists and policymakers to exploit in order to outmaneuver the Lysenkoists at home and the Western rivals abroad.

Author: Mark Hineline

Title: Actual Witnessing: When Scientists Return with Colleagues to Look at Specimens

Abstract: American geologists and geographers began to organize field trips and excursions as part of disciplinary meetings in the 1890s, and have continued the practice to the present day. The New England Intercollegiate Geological Congress, founded by William Morris Davis at the beginning of the 20th Century, exists exclusively to provide revisitations to sites of field work for students in geology, and for working geologists. In this paper, I provide an overview of the practices that make up the organized field trip or excursion, taking as my primary example the Transcontinental Excursion of 1912 of the American Geographical Society of New York. Also organized by Davis, the Transcontinental Excursion traveled 13,000, primarily by train, with 43 invited Europeans aboard; over 100 American scientists participated. In this paper, I define "specimen" as a unit of analysis for understanding field and museum sciences, and I will show that scientists conventionally
return together to examine, describe, and argue about specimens that are too large or remote to collect and curate in museums.

Author: Hiro Hirai

Title: The Principle of Life in Renaissance Natural Philosophy, Medicine and Alchemy

Abstract: In the late Renaissance, especially during the second half of the sixteenth century and the first decades of the seventeenth century, the “newly recovered” writings of prominent ancient authors such as Galen, Hippocrates and Aristotle’s Greek commentators exerted a considerable impact on medicine and natural philosophy. Propelled by this intellectual stimulus, leading minds in these fields started to cast doubt on the fundamental body of doctrines offered in traditional university teachings. These factors fuelled physicians’ and natural philosophers’ debates on living beings and their nature, structure and functions, and even forced them to avail themselves of divergent new ideas. As this period also witnessed the rise of the Paracelsian movement, which was closely related to alchemy, and since the proponents of this current were often themselves physicians, interactions of medicine, natural philosophy and alchemy contributed to the emergence of a number of remarkable interpretations of life phenomena. The present paper aims to provide a synthesis of my work on such interactions by focusing on the notion of the “principle of life” (principium vitae).

Author: Andrew Hogan

Title: Seeing and (Sometimes) Believing: Managing Uncertainty in Prenatal Diagnosis

Abstract: A century ago, William Bateson famously reminded fellow geneticists to “Treasure your exceptions!”: a dictum that remains central to the thinking and practices of genetics today. In postwar biomedicine however, the exceptions that geneticists treasure have become increasingly synonymous with the uncertain results that most clinicians would prefer to avoid. Indeed, biomedical genetics is home to ongoing tensions over the value of – and openness to – ambiguous findings. While physicians seek reliable and reproducible results, more basic genetics research is often driven by the production of unanticipated clinical outcomes. In this paper, I examine institutional and professional infrastructures that contribute to managing these tensions, while facilitating diverse aims. I focus on two techniques used in prenatal diagnosis, chorionic villus sampling (CVS) and DNA microarray, each of which is known to regularly produce results of uncertain clinical relevance. CVS often reveals chromosomal abnormalities that are not actually present in the fetus, while DNA microarray frequently identifies genomic aberrations of unknown significance. Such misleading and uncertain results greatly complicate the time-sensitive aims of prenatal diagnosis, and may be a source of significant concern for physicians and expectant parents. However, ambiguous outcomes also provide valuable data for researchers, as they seek to better understand the genetic basis of disease. This paper examines strategies for managing uncertainty in prenatal diagnosis, including blinding results of unknown significance, reliance on follow-up testing, and tracing long-term patient outcomes. Such approaches have helped to simultaneously further the interests and aims of patients, clinicians, and genetics researchers.

Author: Adrian Howkins

Title: Taylor’s Valley: What the history of Antarctica’s “heroic era” can contribute to contemporary ecological research in the McMurdo Dry Valleys

Abstract: Recent years have witnessed a reevaluation of the scientific legacy of the so-called “heroic era” of Antarctic exploration, which lasted roughly from 1895-1917. Books such as Edward Larsen’s An Empire of Ice (2011) argue that alongside the famous stories of adventure and exploration, most expeditions conducted substantial scientific research programs. In collaboration with scientists from the McMurdo Dry Valleys Long Term Ecological Research (LTER) site, this paper sets out to ask a different question about the scientific legacy of the heroic era: is there anything that the history of this period can contribute to contemporary scientific research in Antarctica? In early February 1911, Griffith Taylor, Frank Debenham and Charles Wright became the first scientists to spend a significant amount of time what is now called Taylor Valley in the McMurdo Dry Valleys. The reports, measurements, sketches, and photos produced by this expedition offer a snapshot of the region’s environment a little over 100 years ago. Looking in particular at streams, lakes, and glaciers, this historical data can potentially expand our understanding of landscape change over time and offer a new perspective on the questions being asked by LTER scientists. Alongside a brief presentation of the results of this research, this paper will reflect on the collaborative process between scientists and a historian in order to contribute to the panel’s central theme of interactions between biologists and historians.
Author: Hansun Hsiung

Title: Dictionary, Phrasebook, Grammar: or, How to Learn a Foreign Language without the Aid of Foreigners

Abstract: Starting in the latter half of the seventeenth century, the concept of a “general grammar” took increasing precedence in intellectual life, acting both as a cognitive schema and as a method of cognition. Simultaneously, a surge occurred in the production of vernacular foreign language textbooks tailored for learners in practical trades without Latin experience. How did textbook editors incorporate “grammar” into these works? How did “grammar” attempt to convert the study of language into a “science”? Finally, what new relationships between readers and books did such a “grammatical” approach enable? My presentation investigates eighteenth-century materials for teaching French as a foreign language. I focus, in particular, on a constellation of works by Pieter Marin (1667-1718). From 1697 onward, Marin produced a series of language textbooks under the titles of La Nouvelle méthode, La Méthode familière, and La Nouvelle Grammaire. A mainstay of foreign language education until their last editions in 1873, Marin’s works enjoyed a readership stretching as far as Japan. By examining changes across editions, and the way in which both European and Japanese learners engaged with them, I argue that grammar’s structural importance clashed with criteria that language pedagogy be not only “useful,” but also “pleasant.” This struggle was most evident in the blurring of generic boundaries, with learners alternating in their usage of Marin’s texts as part ‘phrasebook,’ part ‘dictionary,’ and only sometimes as ‘grammar.’ Such examples indicate that the eighteenth century’s attitude toward ‘grammar’ as a cognitive tool was far more ambivalent than previously believed.

Author: Danian Hu

Title: Revisiting the Criticism of Relativity in China: Overlooked Western Influences and Unexpected Outcomes

Abstract: Earlier studies, including my own work, on the Chinese criticism of relativity during the Cultural Revolution have tended to stress the Soviet influence and the ideological genesis but have overlooked the important impact of some Western physicists; moreover, they failed to spell out personal motives of individual participants in the campaign. Based on newly discovered primary sources, I will revisit the organized criticism, focusing on the group in the Chinese Academy of Sciences (CAS). This study will demonstrate the significant influence of Herbert E. Ives (1882-1953) and Herbert Dingle (1890-1978) on young Chinese critics and reveal the complex reasons that scientists joined the campaign against Einstein’s theory of relativity. Furthermore, it will show how this criticism campaign ironically helped found China’s first national research institute for theoretical physics.

Author: Florian Huber

Title: Glassy Nature: The Blaschka Models

Abstract: The presentation will focus on the glass objects fabricated by Leopold and Rudolph Blaschka. Around 1860 to 1936 they created thousands of lifelike models of marine invertebrates for collections in Europe and the U.S. Their display of organicist aesthetics places the glass models in the context of art nouveau. But they are also embodiments of a scientific worldview. They not only represent something, they also transform and reshape scientific phenomena. A great deal of their fascination seems to stem from their materiality, i.e. their glassy nature, the meaning of the models cannot be reduced to the specific interests of the actors involved. It is rather dependent on a wider cultural context, where glass has had several meanings. In the iconographic tradition, glass was a symbol for purity and evanescence. During the 19th century, it was increasingly used in architecture and became a preferred material of a modernist approach. As a medium for presentation, like in museums or shop windows, it favors the sense of sight by depriving the other senses and thereby producing a distance between the viewer and the objects viewed. Finally, glass was also associated with water, and biologists like Ernst Haeckel stressed the glass-like appearance of jellyfish and other transparent marine animals. The talk will investigate how the meaning of the Blaschka models was constituted through such a network of references, and how these associations shaped the way in which these objects were perceived.

Author: Kuang-Chi Hung

Title: “A Flora with a Capital F”: Asa Gray and the Making of the Flora of North America

Abstract: This paper explores changing meanings of the term “flora” in nineteenth-century botany through a case study of
American botanist Asa Gray’s life-long project, A Flora of North America. I argue that Gray defined the term “flora” in close association with his relationship with the field. In the 1830s, the belief was that a flora project should be based upon botanists’ “liberal and generous exchange of specimens.” A flora project was supposed to be liberal, egalitarian even, and was meant to demonstrate the Creator’s plan in nature. But the expansion of the United States challenged this idealist view of the flora. Particularly during the 1850s, when governmental surveys described an astonishing numbers of novelties and unknown botanical forms, Gray considered the flora nothing more than “a catalogue of species,” and species akin to “coins or banknotes.” Gray argued that anybody who assisted the state in characterizing a national flora ought to be designated legitimate species -producers in the world of botany. Afterward, as the term “flora” became linked to localism and nativism, Gray began to advocate that species were “judgments” based on expertise. He distinguished a judgment-based and nationally-scaled flora as a flora with a capital F. This paper emphasizes that the term “flora” does not necessarily imply a geographically bounded natural entity. Tracing how a flora was constructed historically offers a means by which to capture the shifting boundaries between field and laboratory and between nature and society.

**Author:** J. Benjamin Hurlbut

**Title:** Reactive Institutions: Emerging Technologies and Public Bioethics from Recombinant DNA to Synthetic Biology

**Abstract:** Since the 1970s, public bioethics bodies have come to play an important role in the governance of emerging technologies in the United States. Such bodies have been called upon to serve, in President George W. Bush’s words, as “the conscience of the country,” by discerning, framing and deliberating over so-called “ethical and social issues.” This paper examines the nature of that responsibility by tracing the ways notions of ethical consequence and reasonable public reaction have come to be constructed in relation to uncertainty over what possible futures an emerging technology might bring. I examine the mid 1970’s controversy over governance of recombinant DNA, focusing in particular on Edward Kennedy’s assertion that the expert scientific assessment offered at the 1975 Asilomar meeting was an inadequate basis for public policy, and his proposal that the judgments of Asilomar’s experts be augmented by those of a public bioethics body capable of discerning social and ethical dimensions on behalf of the wider public. I trace the aftermath of Kennedy’s proposal, showing that his demand for an institutional separation of scientific assessment and ethical deliberation established an institutional space for public bioethics even as his recombinant DNA-specific proposal foundered. I argue that this division of labor is reflected in the ways certain bioethics bodies have constructed their own role in democratic governance vis-à-vis science and the public by positioning themselves as institutions of public reason that define the forms of appropriate public reaction to scientifically authorized predictions of possible technological futures.

**Author:** Paul Israel

**Title:** "A New Radiant Force": Thomas Edison's Inquiry into the Implications of Electromagnetic Field Theory

**Abstract:** What happens when a new interpretive framework passes into the hands of a practitioner of applied basic research? Thomas Edison, perhaps the most accomplished technological thinker in the U.S., was such a person in 1885 when he took up the implications of electromagnetic field theory. Edison's recent work on wireless telegraphy coincided with papers by British mathematician and engineer Oliver Heaviside, who, like Edison, was a former telegrapher and a capable experimentalist. The start of Edison's effort is marked by several pages of undated and previously overlooked tables outlining reciprocal relationships between electrical and magnetic energy and the passage of energy through corresponding devices such as electromagnets and condensers. In these pages he began to formulate an applied research program into the convertibility of energy and its propagation through space. Edison hoped to generate new knowledge that might have practical applications. He also sought to identify a new form of energy. He had for years believed in the possible existence of such energy, provisionally named "XYZ," and now prepared to look systematically for "a new radiant force, lying somewhere between light and heat on one hand and magnetism and electricity on the other." Edison's inquiry took him not to Maxwell but back to Faraday's Experimental Researches, from which he adapted ideas and experiments. Adopting Faraday's outlook and methods, Edison pursued XYZ and related questions, hoping to make a fundamental discovery of practical importance.

**Author:** E. Jerry Jessee

**Title:** Radiation Ecologies: Fallout, the Biosphere, and the Limited Test Ban Treaty

**Abstract:** Environmental historians have long recognized that the radioactivity produced by American nuclear weapons tests poisoned the environment and threatened human health. Far fewer, however, have appreciated the ways in which the advent
of radioactive tools in environmental sciences such as ecology, oceanography, and meteorology sparked modern concepts of the Earth as an integrated biosphere. By tracing radioactivity through the landscape, oceans, and atmosphere, these scientists produced a body of empirical data linking the health of human bodies and local geographies to these seemingly distant nuclear events. In this paper, I argue that the environmental knowledge produced by new radiotracer practices underlaid and enabled the environmentalist critique that contributed to the end of above-ground testing with the signing of the Limited Test Ban Treaty (LTBT) in 1963. In telling this story, this paper endeavors to bridge a narrative conundrum that has plagued a more fruitful integration of the history of science and technology and environmental history. How do we tell interwoven stories about science, technology, and the environment without perpetuating staid narrative tropes linking "progress" in the former with "decline" in the latter? By understanding the dual nature of radiation—as both an agent of disease and a tool in scientific progress—this paper points to the signing of the LTBT as an important instance where advancements in science and technology resulted in the first international environmental protection treaty.

Author: Lijing Jiang

Title: Goldfish, History, and Progress: Divergent Understandings of Evolution and the Chinese Development of Experimental Biology in the Early Twentieth Century

Abstract: This talk depicts the diversity of evolutionary interpretations at play in China during the 1920s and 1930s and shows how foreign learning, native environment, available biological materials, and concerns about the nation’s future shaped these divergent approaches. I will focus on the goldfish genetics programs established by the US-trained biologist Chen Zhen (陈桢, 1894-1957), and contrast his approach to the Lamarckian teachings and writings of humanist and self-trained biologist Zhou Jianren (周建人, 1888-1984). Having studied at Columbia University in the early 1920s, Chen returned to China and advocated using the Chinese goldfish as an organism for establishing a uniquely Chinese experimental biology. He successfully demonstrated the Mendelian pattern of heredity in the goldfish, and utilized extensive history records to substantiate that the goldfish evolved from the crucian in China. Chen’s program paralleled the rise of the Morgan school of genetics and inculcated Darwinian evolution, but was initiated at a time when the Lamarckian view of evolution had a long-standing appeal for Chinese students. Zhou Jianren’s translations of Lamarck and his related pamphlets, as a consequence, received greater popularity. These heterogeneous views of evolution within the first generation of modern Chinese biologists shaped the divergent orientations of experimental biology in Chinese universities and in the Science Society of China. This research shows a mixed development of Chinese experimental biology in the early twentieth century and proposes a supplementary, less political explanation to the question of why Soviet Lysenkoism could overtake Chinese academia in the 1950s.

Author: Ann Johnson

Title: Code on the Move: The Circulation of Computer Simulation Tools Between Communities

Abstract: Computer code for producing scientific models is surprisingly mobile. Simulation tools move between widely disparate communities and problems—from physics to economics, from chemistry to structural engineering, from biology to sociology, etc. This paper focuses on two such tools—finite element analysis and continuous fluid dynamics—and tracks their movements from community to community. The purpose of studying their movement is to consider what attaches to the code as it moves—do certain scientific assumptions move with the software? Are those assumptions blackboxed, or visible to the users? The two tools are particularly interesting because they have moved from being FORTRAN codes developed at a small scale and tailored for particular problems to large commercial software packages used widely (and perhaps indiscriminately) across wide application areas. The question of community comes in in looking at how different communities value the exercise of producing the code versus simply using code. How do different communities judge the veracity of models and data produced by the code, especially when the code itself is an import to that community?

Author: Eric Johnson

Title: Darwin’s Russian Defender: Peter Kropotkin’s Struggle Between Neo-Darwinism and Neo-Lamarckism

Abstract: The German “Neo-Darwinist” August Weismann’s reputation as the greatest evolutionary thinker of the nineteenth century after Darwin was only codified following the modern evolutionary synthesis in the 1930s. His famous debate with Herbert Spencer was widely hailed as undermining the Neo-Lamarckian view of the inheritance of acquired characteristics. However, as I will demonstrate, Weismann’s germ plasm theory of heredity was not based on empirical evidence but was predicated on philosophical principles following a dialectical method of reasoning. The flaws in
Weismann’s approach were laid out in a series of articles in the British journal The Nineteenth Century written by the Russian naturalist-in-exile Peter Kropotkin whom historians of science have largely judged as falling on the “wrong side” of the evolutionary debate. But rather than being an ideological defender of Lamarck, Kropotkin saw this pursuit as defending Darwin’s views on the direct action of environment in evolution, or what today would be understood as the non-genetic heritability of phenotypic plasticity.

**Author:** Jeffrey Johnson

**Title:** Dilemmas of 19th-century Liberalism among German Academic Chemists: Shaping a National Science Policy from Hofmann to Fischer

**Abstract:** With reference to the history of chemically-related national scientific institutions in Germany, from the founding of the German Chemical Society under the leadership of August W. Hofmann to the influence of Emil Fischer on the early institutes of the Kaiser Wilhelm Society, this paper will reflect on the political as well as the scientific implications of this history and in particular the dilemmas that they posed for Hofmann and Fischer as acknowledged leaders of the German chemical profession, and as scientists sharing a 19th-century liberal, internationalist outlook. As Alan Rocke suggested in the last chapter of his Kolbe biography, liberals like Hofmann (and probably the majority of German chemists in his generation) could not ignore the often virulent political context of nationalism and anti-Semitism that pervaded segments of German society, including the universities and the bureaucracy. As Hofmann's successor as professor in Berlin and as leader of the Chemical Society, Fischer had to confront similar pressures, but his dilemmas became even greater and his path more difficult with the founding of the Kaiser Wilhelm Society in 1911, and coping with the critical and horrific role of chemistry in the First World War. Both Hofmann and Fischer were in a position to shape the nascent national science policy of the Second German Reich. Whereas Hofmann's efforts had a relatively happy and successful outcome, however, the war brought a much bleaker end for Fischer and the 19th-century liberal ideals that had inspired him.

**Author:** Timothy Johnson

**Title:** Growing Concerns: Selective Science and the National Fertilizer Association, 1910-1950

**Abstract:** Science does not sell itself. Although historians have focused on the impact of Justus von Liebig’s chemical theory of plant nutrition in transforming agricultural practice, it would have had a limited impact if fertilizer manufacturers had not made them financially appealing to farmers. This paper will look at the history of the National Fertilizer Association (NFA) to explore how agricultural industries have sought to promote favorable scientific findings to expand markets and burnish their own public image. Starting in 1910s, the NFA funded its own farm demonstration work that promoted elevated fertilizer application, but its publications also summarized publicly funded agricultural research that supported the interests of the fertilizer industry, as well. Its members also worked to dismiss agricultural practices that they perceived as a threat. For example, with the advent of organic gardening in America in the 1940s, the NFA distributed materials that portrayed compost as an unsanitary and inadequate fertilizer. While it may not be surprising that these selective activities provided a skewed picture of agricultural science that served the interests of fertilizer manufacturers, this paper will take a closer look at these activities to examine the imperfect connective tissue between laboratory and landscape that has helped translate scientific theory into commercial reality.

**Author:** David Jones

**Title:** Seeing and Doing: Therapeutic Fashion and the Interpretation of Coronary Angiography, 1950-1970

**Abstract:** The rise of coronary artery disease in the early twentieth century created a problem for American doctors. They quickly came to suspect that the symptomatology -- patients who reported chest pain or pressure -- was ambiguous. They could not discern whose angina pectoris was cardiac or neurotic. Cardiologists developed two technologies to resolve this ambiguity and reveal the underlying pathophysiology: electrocardiography and selective coronary angiography. Their use of these technologies consolidated their status as expert physicians with privileged knowledge of their patients’ bodies. Doctors relied explicitly on textual metaphors for both techniques. They “read” EKGs and angiograms to determine whether coronary pathology existed and how it was distributed. In the 1950s and 1960s cardiologists and cardiac surgeons needed to know whether coronary atherosclerosis was a focal or diffuse process. The answer to that question determined what sorts of therapies made sense. These texts, however, initially proved to be open to diverse interpretation. Based on an analysis of surgeons’ notes from the Cleveland Clinic and the broader medical literature, this paper shows how different doctors read coronary angiograms and reached contradictory conclusions about the pathophysiology of coronary atherosclerosis in the 1950s. Their readings shifted as therapeutic capacity and fashion changed in the late 1960s with the rise of coronary artery
bypass grafting. Convinced of the efficacy of this new procedure, surgeons read angiograms differently and increasingly saw only focal atherosclerosis amenable to surgical intervention. They read into the heart what they needed to see to justify their new operation.

**Author:** Matthew Jones

**Title:** A Tale of Two Algorithms: Sharing at the Emergence of Data Mining

**Abstract:** Among the standard tools for data miners are two families of algorithms, “Decision trees” and “APRIORI.” This paper studies how the quite different disciplinary trajectories of these algorithms intersected in the creation of “data mining” or “knowledge discovery in databases” during the 1990s. Decision trees emerged from an empirically-focused form of machine learning and from statisticians displeased with the theoretical orientation of this discipline; APRIORI was created by database engineers as a superior form of querying. In the sharing of these algorithms, disciplinary differences were omnipresent: statistical concerns about significance and interpretation were in tension with database worries about input/output latency and computational efficiency. Data mining transformed all three fields, but it did not emerge as an academic discipline in its own right. The disciplinary tensions remain unresolved, often productively. Focusing particularly on two foundational conferences in the early 1990s, one at JPL, the paper will track the emergence new cross-disciplinary practice of data-mining in the sharing among fields of such algorithms: data mining prospered among business and research sectors little concerned about the disciplinary divides and rivalries that undergird and sustain the practice.

**Author:** Gustav Källstrand

**Title:** The Appearance of the Nobel Prize

**Abstract:** This paper describes how the beginnings of the Nobel Prize must be understood against the backdrop of an understanding of science as a national resource in the early 20th century. It also discusses plausible ways in which this may have affected the way the prize-awarding process has functioned throughout the prize’s history. The Nobel Prize was first awarded in 1901, but already in 1897 it made its first appearance in the press. On January 2nd that year, the will of Alfred Nobel was published in a Swedish newspaper. The Swedish press immediately described the prize as a resource for Sweden, and the prize was thus linked to a Swedish national identity. This national pride was directly derived from the prize’s presumed international prestige. This process took place in a time when science was also seen as an important national resource. It was pivotal in the semi-imperial project of mapping northern Sweden, and it was also seen as part of a modernizing project, where railways, voyages of discovery and industrial development were the markers of progress. The Nobel Prize needs to be understood in the context of a nation that was experiencing an optimistic period in relation to science and progress. With this prize, the national pride could be expanded internationally. The hopes were expressed along two lines. First: because of the Nobel Prize, the world would turn its attention on Sweden. And second: because of this, new scientific institutions would spring up, that would be appealing to international scientists.

**Author:** Peter Keating

**Title:** Molecular oncology's hybrid entities and the redefinition of risk: the case of Triple-Negative Breast Cancer

**Abstract:** While much attention has been devoted to the creation of environmental risks and catastrophes ranging from ‘mad cow disease’ to the release of genetically modified organisms as distinctly post-modern sources of risk, historians of biomedicine have also shown that the emergence of risk factors of disease is a distinctly modern phenomenon. Pathology deserves special attention with regards to the rise of prognosis and risk evaluation. Considered moribund in the mid 1970s, by drawing on technologies from the life sciences, pathology reoriented itself from a largely descriptive science to a predictive specialty that manages risk in terms of both diagnosis and treatment. It has done so by creating new diseases whose definition is variously grounded in molecular pathology and the clinic. Such is the case of triple-negative breast cancer or TNBC: clinicians openly wonder whether “TNBC is a distinct pathological subtype of breast cancer or a pragmatic category for determining eligibility for clinical trials and guiding individual patient treatment”. This paper will explore the rise and diffusion of TNBC as a hybrid category characterized by distinct, yet labile, risk profiles. While the category was created in 2006, its constituents had been available to practitioners since late 1990s. We will show that far from being overlooked, however, TNBC could not be seen until, with the advent of high-throughput genomic analysis, it was described as a risky phenotype.
**Author:** Christine Keiner

**Title:** Invasion Biology, Environmental Diplomacy, and the Panama Sea-Level Canal Debate

**Abstract:** From the early 1960s through the mid-1970s, the U.S. government spent millions investigating the feasibility of using nuclear explosives to replace the Panama Canal with a non-lock waterway. While the megaproject never came to fruition, the controversy is worth remembering as a foundational initiative of environmental diplomacy between the United States and its strategic ally Panama, and for the ways in which researchers used it to stimulate interest in marine biotic interchange and tropical ecology and conservation. Led by biologists associated with the Smithsonian Institution, who had struggled to promote tropical research since taking over the Panama Canal Zone's Barro Colorado Island facility in 1946, the controversy featured the then-novel issue of non-native marine species exchange as a potentially greater threat than radioactive fallout. Framing the proposed canal as a fait accompli, Smithsonian biologists and administrators publicized the situation as a unique opportunity for promoting the Panamanian isthmus as a strategic site for investigating the biogeographic origins, maintenance, and loss of tropical marine biodiversity. Though their risky strategy irritated diplomats and engineers, the Smithsonian provocateurs forced officials to acknowledge the project's environmental costs, and demonstrated the social relevance of trans-isthmian ecological and evolutionary research long before the "biodiversity crisis" or "invasive species" became household words. The sea-level canal controversy thus serves as a useful lens for examining changing postwar roles of scientists in international environmental politics, especially regarding new perceptions of risk associated with Cold War megaprojects and raising awareness of the importance of tropical marine and invasion biology.

**Author:** Shreeharsh Kelkar

**Title:** The Elite’s Last Stand: Negotiating Toughness and Fairness in the IIT-JEE

**Abstract:** This paper looks at the values of the scientific elite that organizes the annual Joint Entrance examination (JEE), the entrance exam for entry into the prestigious undergraduate programs of the Indian Institutes of Technology (IITs). Using a variety of textual sources, I show that the form that an examination takes depends not just on its stated intentions (finding people endowed with a certain kind of competence) but also on the complicated institutional relationships that the exam’s stakeholders—in this case, middle-class elites, interest groups, the State and institutions of higher education—are embedded in. In my talk, I will particularly focus on the value of “toughness” which translates into a debate over “subjective” versus “objective” questions; a terminology used by the IIT faculty themselves. Since the JEE is science exam, it consists of asking students to solve certain kinds of, and often, highly difficult, “problems.” These problems can be expressed as “subjective” questions in which the student is expected not only to solve the problem but also demonstrate the way he reached his solution. In contrast to these are “objective” questions where the problem is expressed as a multiple-choice question. Surprisingly, the IIT faculty come down on the side of "subjective" questions because they see them as less susceptible to coaching, and therefore testing for a certain kind of innate talent rather than just hard work and endurance. Their efforts over the years have taken the form of tinkering with the right mixture of subjective and objective questions in the exam.

**Author:** Vera Keller

**Title:** Scarlet Letters: The Experimental Research of Art in the Early Royal Society

**Abstract:** A prominent part of the early experimental researches of the Royal Society was the investigation of art materials, including dyes, paints, lacquers, enamels, porcelain, engraving processes, and paper. Researches into art materials included both the restoration of ancient materials, such as the famed ancient purple dye, and the discovery of the new, such as “a new kind of paint with beaten eggs.” The materials of art lay at the juncture of craft secrets, amateur interests, antiquarianism, questions of physical properties, and discoveries for the benefit of the public. They belie distinctions between craft, art and science. This paper explores in particular an unknown archive of Theodore de Mayerne’s experiments on scarlet dyes from the 1630’s and 1640’s investigated within the Royal Society in the 1660’s. Such experimentation viewed color through the multiple lenses of profit, aesthetics, and physics. It dramatizes the attention paid in the early Royal Society not only to the content, but the form of new experimental knowledge.

**Author:** Yoshiyuki Kikuchi

**Title:** Only Connect: Laboratory Design and the Genesis of Physical Chemistry in Meiji Japan

**Abstract:** Recognizing “The Enduring Importance of Place” (Christopher Henke and Thomas Gieryn, 2008) provides historians of physical sciences with a powerful interpretive tool to understand the genesis of an
interdisciplinary teaching and research regime in a particular place and socio-political and cultural context. Inspired by Michel Foucault’s classical analysis of prisons, the anthropological concepts of “contact zones” (Mary Louise Pratt, 1991 and 1992) and “trading zones” (Peter Galison, 1995 and 1997), and colonial science historians’ “parameters of locality” (David Wade Chamber and Richard Gillespie 2000), this presentation examines how laboratory design, affected by a layer of such contexts, encouraged the development of the border discipline of physical chemistry in late nineteenth- and early twentieth-century Japan. For this purpose it focuses on an important episode in the history of Japanese chemistry, i.e. the construction of a general chemical laboratory for Tokyo University between 1885 and 1888, designed by German-trained chemist Wilhelm Nagayoshi Nagai (1844-1929) and redesigned by British-trained Joji Sakurai (1858-1939). At times a messy interaction between school bureaucracy and scientists’ aspirations, visualization of the pedagogical practice of supervision, collision of German and British scientific cultures staged outside Europe, and laboratory design as part of urban design, this case also reveals the “brick and mortar” material basis of interdisciplinarity. This presentation argues that the spatial arrangement of laboratory design connects and divides 1) teachers and students, 2) insiders and outsiders, 3) disciplines, and 4) subdisciplines.

Author: Sharon Kingsland

Title: Agriculture and the Life Sciences in the Cold War Context

Abstract: Technological innovation in the postwar period meant improved laboratories for research on problems of physiological ecology and agroecology. These areas of research addressed Cold War concerns about feeding the world’s population, one solution being to make plants more efficient converters of the sun’s energy as well as better adapted to harsh environments. Starting in the U.S., and then spreading worldwide, new laboratory designs enabled scientists to pursue multi-disciplinary research with agricultural ends. The USDA at the same time innovated in various ways in response to Cold War needs, promoting scientific agriculture as the “keystone of abundance.” “Pioneering” research laboratories were designated in the 1950s to facilitate basic research, while important discoveries in biology emerged from agricultural settings. Historical research on the wide-ranging innovations undertaken in the Cold War context should broaden and deepen our understanding of the history of life science, the Green Revolution, and modern environmental history.

Author: Rebecca Kinraide

Title: Contextualizing Conflict

Abstract: I will discuss how I incorporate History of Science into my Medical Debates class taught in the Boston University Writing Program. By using HoS readings, topics, and episodes, the class helps students contextualize both past and present medical debates. Students, many of whom are on a pre-med track, enjoy learning the "back story" to a number of medical debates that are current today. In addition they learn how science can be a lens to examine the values and concerns of society. Transference of skills is a major pedagogical goal of the class. Over the course of the semester the students apply the skills they have learned researching historical medical debates to evaluating current debates: close reading, genre awareness, understanding the reliability of sources, recognizing logical fallacies, etc. I will bring sample syllabi, assignments, and handouts to aid in my presentation.

Author: Peter Kjaergaard

Title: Inventing a Viking ancestor: Prestige, pressure and human evolution in interwar Scandinavia

Abstract: During archaeological excavations in the southern part of Greenland in the 1920s evidence emerged to explain the eventual extinction of the Norse settlers that had occupied these parts for almost five hundred years until sometime in the fifteenth century. Among the many skeletons excavated from Gardar, two stood out: One as the most likely remains of Jón Smyril who died in 1209 after serving as Bishop of Greenland for twenty years; the other because of the size and thickness of its skull. Professor of anatomy at the University of Copenhagen, Frederik C. C. Hansen, was so convinced of the uniqueness of the skull that he felt compelled to announce a new human species, Homo gardarensis, even though he knew the skeleton itself could not be much older than 700 years. To explain the abnormality and to justify his sensational announcement he referred to vestigial evolutionary traits that emerged through unbroken inbreeding over many generations of Viking settlers from Norway. Despite the obvious disadvantage of not being able to claim ancient human fossil remains from any of the Nordic countries, Hansen’s ingenious interpretation provided an ancestor sufficiently primitive to compete with other recent findings from around the world. The Nordic candidate for a unique human species entered a race with many national contestants, but despite a brief claim to international fame, Homo gardarensis was soon forgotten. This talk will use the example of Homo gardarensis to unravel the historical complex of science, politics, geography, national pride, cultural identity, disciplinary hierarchies, and personal ambitions in early twentieth century European human origins research.
**Author:** Joel Klein  
**Title:** Daniel Sennert and the Quest for a Nearly Universal Medicine  
**Abstract:** In the seventeenth century the Wittenberg professor Daniel Sennert (1572-1637) developed an experimental chymico-atomical natural philosophy that had an important influence on the development of later corpuscular philosophy. Likewise, his understanding of animated seminal principles in the generation of living things was both unique and significant in the history of studies on generation. In this paper I explore the intersection of Sennert’s chymistry and natural philosophy with his advancement of new medical theories and treatments. In particular, from a study of the nineteen-year correspondence with his son-in-law and fellow physician, Michael Döring (d. 1644), which amounted to almost 200 letters, I trace the development of Sennert’s attempt to develop a universal medicine. While colleagues in their self-styled “collegium chymicum” sought the philosopher’s stone, Sennert and Döring investigated the synthesis of potable gold and other potential remedies from the works of a host of alchemists, and eventually Sennert excitedly reported to Döring the twenty-step process he had used to produce one such remedy. From Sennert’s critical analysis in both his published works and correspondence, I investigate the place of these universal remedies in Sennert’s larger medical and chymical philosophy of nature.

**Author:** Ursula Klein  
**Title:** Uses of Science in the Prussian State around 1800  
**Abstract:** After the Seven Years War (1756-63) some Prussian ministers hired savants as officials and further promoted the “useful sciences.” In so doing, they pursued a dual goal: first, the promotion of State-directed manufacture—mainly mining and the connected industry—through scientific and technological expertise; and second, the establishment of new values in the State administration. On the upper level of State officials (“cameralists”) nobility and military honors had long been privileged values that outshined the values of disciplined work and technical knowledge. On the low level of technical officials the value of craft secrecy was to be replaced by the willingness to communicate knowledge within the corps of officials and to take up foreign technical knowledge. Values of science—in particular, disciplined work, openness, and written communication—were understood as pedagogical instruments that fostered the transformation of values in the State bureaucracy.

**Author:** Theodore Koditschek  
**Title:** Herbert Spencer’s Late Lamarckism  
**Abstract:** During the 1890s, Herbert Spencer became entangled in a controversy with August Weismann over the inheritance of acquired characteristics. By this time, Spencer’s major writings on biology (The Principles of Biology, 1864–7) were long behind him, and his interests were primarily in questions of ethics, government, and social evolution. This paper will examine what was at stake for Spencer in this return to biology. Why did this ageing, eminent Victorian sage set himself up as one the most vigorous defenders of “use inheritance” at a time when Lamarckism was coming under increasing attack? My hypothesis is that three factors were at work. (1) Spencer was determined to preserve an understanding of evolution as a progressive and a purposive process. (2) He was determined to reassert the biological foundations of social evolution, undercutting socialists and reformers who would solve social problems through state intervention. (3) He was determined to dispute the supremacy of natural selection as the primary mechanism for evolution, insuring that social change would be interpreted in an evolutionary framework and construed within a human, historical frame. In short, Spencer was determined that his synthetic, universalizing version of evolution should prevail over the biological theories of the neo-Darwinists, and the social theories of E. B. Tylor and other anthropologists. To this end, it was necessary to defend some Lamarckian mechanism by which human purpose could feed back into biological processes, and in which biological processes could be depicted as constraining human action and will.

**Author:** Amy Kohout  
**Title:** Working Vacations: Dr. Mearns and the Museum  
**Abstract:** Historians of science have given much attention to the spaces of scientific practice; this paper examines connections between not only where, but also when scientific work happens. Thinking about science “on vacation”—where vacation can be a time, place, or even a state of mind, prompts a reconsideration of what counts as work and why it matters. These questions have special significance for actors who are not easily categorized, actors with multiple identities and
occupations. Consider the example of Edgar Mearns, a late nineteenth- and early twentieth-century army surgeon and ornithologist who collected specimens for the Smithsonian everywhere he was stationed, from the Arizona Territory to the Philippine Islands. Though it would be easy to understand Mearns as a doctor with a natural history habit, an examination of his leave time suggests that this reading of him might be too simple. On his vacations, Dr. Mearns often traded the field (of battle, or imperial occupation, or even mundane fort duties) for the museum, where he studied his specimens and wrote up his research. In thinking through what we get from examining Dr. Mearns’s working vacations, this paper suggests that we need to continue to explore the blurry boundaries between labor and leisure, home and the field, and life and work.

Author: Diana Kormos-Buchwald

Title: Einstein's Correspondence: Communities of Knowledge & Friendship in 20th Century Physics

Abstract: Albert Einstein's substantial correspondence over more than half a century allows insight into communities of knowledge at a time when epistolary culture was gradually declining in its overall significance for the communication patterns of modern scientists. We shall examine the outlines and intensity of his letter exchanges with particular correspondents over time, and attempt to extract information about the topics deemed most significant or urgent. But we shall also glean insight into Einstein’s less well known engagements, as well as his personal, professional, and political preoccupations.

Author: Gladys Kostyrka

Title: Building viral parasitism at the interface of biology and medicine, from 1980s until today

Abstract: Viral ecology and evolution have long been almost exclusively biological questions, building only rare and limited bridges with medical issues. During the last thirty years, however, profound transformations in the fields of viral ecology and evolution occurred, ranging from the emergence of viral aquatic ecology, microbiome and virome studies, growing connections with animal ecology, to recent advances in experimental virus evolution. Some of those developments are only very distantly connected with medical issues. Yet most of them have built complex interactions with viral pharmacology and epidemiology. In this paper I describe these interactions and retrace the history of their construction, focusing on two main case studies: influenza viruses and rabies viruses. These RNA viruses are particularly interesting for at least two reasons. First, they circulate between different host species, which force researchers to interrogate the transmission processes, the factors leading the virus to “jump” the species barrier, the ecology of the virus’ vectors and reservoirs, and the factors explaining the apparent apathogenicity of the virus in some of its hosts. Second, they are rapidly evolving, due to the absence of an error-correcting polymerase activity, leading to a high mutation rate per generation. This characteristic places viral evolution at the centre of the biomedical enquiry: can we build medical treatments or strategies on the basis of a better understanding of RNA virus evolution? Ultimately, this paper shows how the growing connection between the biology and the medicine of viral parasitism contributed to the development of “disease ecology” as an interdisciplinary field.

Author: Harun Kucuk

Title: Experience in 18th-Century Istanbul

Abstract: Using medical manuscripts and period chronicles, I examine the troubled relationship between medicine and natural philosophy in eighteenth-century Istanbul. While the Islamic colleges continued to be the disciplinary home to scholastic natural philosophy, the medical profession was more diverse both demographically and in terms of the theoretical commitments of its members. In this context, I recount the story of the emergence of the Ottoman medical community as a self-regulating entity that valorized experience as a legitimate means to creating new theoretical knowledge. I explain how physicians used the rhetoric of public good to elevate their standing at the sultan’s court and to gain control over natural philosophical discourse in Istanbul – thus weakening the authority of textual scholarship and of medieval texts. Finally, I present the would-be Ottoman academy of sciences and, the anonymous Turkish translation and publication of Christoph Eberhard’s Specimen theoriae magneticae (1720) as developments that cemented experience as being the primary route to reliable knowledge.

Author: Whitney Laemmli

Title: Paper Bodies: Labanotation and the German State, 1910-1935

Abstract: In the 1910s, 1920s, and 1930s, the body held a central place in the German cultural imagination. This moment,
however, was not merely characterized by nudists seeking transcendence in open meadows, a burgeoning modern dance scene, or the resurgence of gymnastics associations. In Munich and Berlin, dancer and choreographer Rudolf Laban was at work developing a system for translating the complex physicality of human bodily movement onto the two-dimensional surface of paper. The resulting system, Labanotation, drew upon scientific ideas about space, physiology, and bodily effort, and—in the ensuing decades—was taken up by a remarkable number of actors, including movement therapists, robotics designers, management consultants, anthropologists, and factory managers. This paper, however, will focus on the immediate context of Laban’s early notation work. Specifically, I will examine the state’s use of Labanotation to coordinate nationwide dance spectacles and to develop a German archive of historical movement and dance. In essence, I will demonstrate how this paper tool became an essential part of the state's efforts to manage its citizens and shape a national identity. More broadly, I will explore the complex intertwining of bureaucracy and art, the use of notation for purposes of legibility, accumulation, and control, and the imbedding of ideology in systems of inscription.

Author: Kevin Lambert

Title: A Scientific Object at the Paris Opéra: Jean Phillipe Rameau’s Pygmalion Moment and Sentimental Empiricism as a Culture of Affect

Abstract: In 1748, composer Jean-Phillipe Rameau put a vibrating body on display at the Paris Opéra in order to promote acceptance of his theory of music by the Royal Academy of Sciences. As is well known, mathematician Jean Le Rond d’Alembert gave support to Rameau’s ambition because he thought Rameau’s music theory represented music in a way analogous to the way mathematics should be used to make scientific representations of nature. But Rameau’s demonstration of the vibrating body at the Opéra also had much in common with the public performance of experiment in the mid18th-century. Indeed, the audience for Rameau’s operas overlapped with the audiences that experienced the display of more obviously experimental effects. By examining the way this Pygmalion moment was discussed in the pamphlets and reviews written by sensitive enlightened listeners such as Baron von Grimm, something about the way scientific effects moved French enlightenment bodies can be recovered. I will argue that enlightened French audiences registered their experience of science in the age of sensibility with their bodies; bodies affected by what they saw, heard, and most importantly, felt. The French enlightenment was a culture of analysis but it was also a culture of affect and the way enlightenment audiences were moved provided evidence for the vitalist materialism of the age.

Author: Roger Launius

Title: Comparing Antarctic Scientific Stations and Space Operations: Analogies of Public/Private Partnerships for Scientific Investigation

Abstract: In 1957 the United States established the first permanent U.S. scientific stations in Antarctica—McMurdo Station and Little America at the South Pole—as part of the International Geophysical Year (IGY), a broad-based scientific effort to understand the geophysical properties of the Earth. The next year the United States established NASA, in direct response to the Soviet Union’s success in engaging in space science undertaken also as a part of the IGY. Over time the sponsorship of Antarctic stations to establish a geopolitical presence and advance scientific efforts in Antarctica became less and less inherently governmental and more privately funded and operated. At the same time the space activities pursued by NASA have remained virtually 100 percent governmental activities. There is almost no corresponding private sector involvement in space operations. Are there lessons for NASA in the context of Antarctic scientific management? How might these two stories relate to each other in considering such future space science activities as a lunar base or space station support and a gradual transition from government activity to public/private efforts? This paper will emphasize the manner in which similar and relates circumstances, priorities, economies, and other patterns have appeared in these related instances. While much is known about the history of these earlier efforts in general, information about their details, especially their financing and political relations have been largely unexplored. This study will make explicit these comparisons.

Author: Matthew Lavine

Title: “X-Rays... And You:” Art conservatorship as a means to legitimize and humanize x-ray technology in the mid-twentieth century

Abstract: The earliest x-ray generators were physically intimidating and dramatically unpredictable machines, alternately regarded by the public as miraculous and malicious. The median sentiment was neither positive nor negative, but hyperbolic. By the 1930s, the technology had been considerably refined, and rendered reliable and largely free of unforeseen dangers. Yet while the novelty of clinical radiography had worn off, horror stories and unrealistic expectations from that earlier period
were still mainstays of the public discourse about x-rays. Accordingly, equipment manufacturers like Westinghouse and General Electric engaged in public relations campaigns in the mid-twentieth century aimed at presenting x-ray machines as sedate, useful, and wholly domesticated technologies. Their use in art museums was an important element of these campaigns. Paintings and statues, precisely because they did not connote the sickbed or the laboratory bench, made ideal "patients." Not only could artwork not be damaged by x-ray exposure, it presented an intuitive benchmark for what x- irradiation could actually accomplish. Through the manufacturers' promotion of artistic radiography that showed the delicate internal structures of a flower, or that revealed hidden masterworks, prospective patients' minds might be set at ease, but equally importantly, their opinion of the precision that such instruments were capable of could be considerably improved. While x-rays were useful to scholars and conservators of art, the larger and more immediate benefit accrued to the manufacturers who happily made machines and technicians available to museums, and infallibly reported the results in press releases and brochures.

**Author:** Ian Lawson

**Title:** Sitting Inside the Eye: Robert Hooke's Public Optical Demonstrations

**Abstract:** The recent wave of scholarship about Robert Hooke has made much of the interplay of the mechanical and philosophical in the work of the Royal Society's 'philosophical servant'. The giant insects of Micrographia are justifiably famous, both as the presentation of novel visions and an explicit vindication of the new experimental philosophy. Less attention has been paid to the materiality of Hooke's demonstrations themselves at Royal Society meetings and Gresham College lectures. This paper explores the recurrence through Hooke's life of the intersection of optical technology, authority, and the performance of knowledge within his public lectures. While the presentation of microscopical vision as intricate drawings was appropriate in Micrographia, public demonstrations required different instrumentation. In 1663, Robert Hooke was ordered by the Royal Society to construct an artificial eye and a camera obscura in preparation for a visit by King Charles II. The king never came, but the objects re-appeared in a series of lectures given in the 1670s and early '80s in which Hooke presented to the Society's Fellows and members of the public his views on the 'New Optics' heralded by Kepler and Descartes. Situated in a book, a large room, or an intimate meeting, ideas of visuality and performance arose from the interplay of instrument and imagination. Though all demonstrating the mechanism of vision, the eye, the camera obscura, and the microscope demonstrated to the audience – and Hooke himself – different modes of seeing and had, I argue, subtly different epistemic implications for understanding the sense.

**Author:** Clarissa Ai Ling Lee

**Title:** Speculative Turns in the Standard Model of Particle Physics

**Abstract:** This paper will focus on the development of the Standard Model in tandem with developments in the theories of fields and particles, beginning from the field theory of classical mechanics to its current status in quantum field theory. Such analysis involve tracing the speculative turn of the ontological (formal/mathematical) and epistemological (philosophical axioms) in defining the mechanical view of the universe: from Lucretius’s conception of theclinamen to the present semi-classical representation of the field, with the potentiality of the Higgs that could push for a more extended, and revision, of the Standard Model concerning our comprehension of the universe. The Standard Model is a loose structure of known elementary particles and the forces that hold them at the range of their effective interactions. The model diagrams the phenomenology of the physical world from its most micro-specific to interactions at the cosmic and galactic scale. I begin my exploration by first considering the status of field and particle theory at the midpoint of the mid-nineteenth century to begin grounding the speculative-ladenness of theories culminating in the Standard Model. I submit that a speculative ontology allows for a more extensive, and durable, framework than either pure hypothesis or the theory of underdetermination for explaining the theoretical and experimental turns in relation to how physical states can best be approximated and phenomenal paradoxes be explained. Speculation, such as through the examples of supersymmetry and extra large dimensions, is important in shaping particle physicists’ thinking about the scale and status of the model.

**Author:** Seung-joon Lee

**Title:** Popular Science and the Wartime Dietary Reform Campaign in 20th-Century China

**Abstract:** Among the various sub-disciplines of science and technology, none has been more attractive to a public audience than nutrition science because of its close relationship to popular concerns about bodily health and dietary curiosity in everyday life. For this reason, nutrition science was vulnerable to functioning as an ideological tool used by the authorities to direct popular eating habits to achieve certain political purposes. However, even without state intervention, nutrition science itself tended to have a strong didactic impulse, going far beyond limited academic circles to influence the public’s decisions...
on what to eat and what not to eat. Twentieth-century total war galvanized the convergence of the state apparatus, nutritional knowledge, and popular health concerns to create a social phenomenon with few collisions, because the most nutritious yet most economical public meal services were urgently required to meet food demands on an unprecedented scale during wartime. Nonetheless, this does not mean that the government claimed to have carte blanche to inculcate proper eating behaviors among the public. Nor did nutritional experts uncritically prescribe a new dietary regimen to non-expert audiences in the name of national salvation. Instead, this article argues, popular concerns about bodily health and culinary curiosity and its willing participation into dietary reform campaigns prevalent in major Chinese cities not only paved the way for the popularization of new nutritional knowledge, but they also helped the state-led wartime dietary reform campaigns during the second Sino-Japanese War.

Author: Victoria Lee

Title: Activation and Redistribution: Nutritional Hopes for Japanese Fermentation Science, 1918-1945

Abstract: This paper explores early technologies to manage nutritional resources in Japan before and during the Second World War. It traces experimental creations such as synthetic sake, chemical soy sauce and fermented vitamins against changing nutritional ideas, by fermentation experts ranging from scientists at the Institute of Physical and Chemical Research (Riken) to technicians in soy-sauce companies. In an era of serious riots against rising rice prices (1918), as well as gradually increasing consumption of new Western meats and vegetables in cities, experts came to connect consumption in daily life to expensive resources available in the landscape. They measured vitamins (a new concept, discovered in Japan) and amino acids in foods in order to understand the nutritional economy. In a national diet where fermented goods constituted significant staples, experts dreamed not of margarine but of adjusting microbial activities to redistribute nutritional resources more efficiently for the population and for the agricultural economy. Some of their original creations became mass-produced and sold, and these trends expanded and intensified sharply under state-coordinated research on new ways to generate food supply and food substitutes during the war. They serve as early examples of how Japanese fermentation experts studied microbes as a means to address the needs of a "resource-poor" and "overpopulated" country. Efforts to manage, synthesize, or develop new technologies from fermented goods betrayed not only their economic importance, but also a growing vision of microbes as useful nutritional and industrial resources that would powerfully shape Japanese biotechnology in the postwar period.

Author: Bill Leeming

Title: “In civilized countries responsible parents no longer leave reproduction to the vagaries of chance”: Authority and Insight in Fostering Applied Human Genetics in Medicine in North America between 1930 and 1960

Abstract: This paper focuses on the use of prolepsis to foster medical interest in applied human genetics between 1930 and 1960. Specifically, beginning in the 1930s, chromosomal theories on “linkage” and chromosome “mapping” were promoted as being likely to produce new tools for identifying persons deemed genetically at risk for disease by linking physical signs and hereditary processes. At the same time, precise explanations of hereditary processes remained highly theoretical and the aetiological mechanisms underlying hereditary processes were uncertain. Techniques in heredity counseling were based almost entirely on the calculation of empiric risk figures for familial diseases and Mendelian accounts of biological relatedness. Linkage theories, by comparison, were expected to provide ways of identifying the carriers of “hidden genetic defects.” And chromosome mapping would, in time, yield detailed and predictive insight into the roots of the genetics of disease. The paper begins with a consideration of the historical confluences of heredity counseling and genetic counseling. I argue that the unfolding relationship between genetics and medicine can best be understood against the background of the shift in emphasis in conceptualizations of recurring patterns of disease in families from “biological relatedness” to “related to chromosomes and genes.” There follows an account of the growth of multiple bases of interest in chromosomal theories on linkage and chromosome mapping. It shows how growing acceptance of chromosomal theories on linkage and chromosome mapping supported orientation and directions for the development of new diagnostic practices in the 1960s.

Author: Kirsten Leng

Title: Sexual Science as Gendered Science? Considering the role of women and questions of gender in early 20th century sexology

Abstract: This paper highlights the role of gender in the content and creation of early 20th century sexology in Europe. Specifically, it focuses on the key role women intellectuals and activists played in the production and dissemination of
sexological knowledge, and in the very constitution of sexology as a discrete field of scientific inquiry. It also draws attention to the importance of debates and activism surrounding the contemporaneous “Woman Question” in prompting sexological study. In this paper I bring forward women’s crucial contributions in three ways. First, I sketch out the vast, transnational networks that were forged across Europe between 1890 and 1930 that connected recognized male “pioneers” of sexology with leading women intellectuals and activists. Second, I elaborate women’s roles in initiating these networks and facilitating exchanges of ideas through journals and other publications. Third, I explore some of the key intellectual contributions made by women to sexological thought, and how they were received by their male peers. Through this gendered analysis of sexology in turn of the century Europe, I aim to challenge existing historical narratives which represent sexology as somehow an always already “expert” and exclusively male discourse. Instead, I maintain that sexology was constituted as a field by a variety of “expert” and “non-expert” voices; that sexological knowledge was produced by women and men; and that sexology’s emergence was inseparable from contemporaneous debates surrounding changing gender roles and identities.

**Author:** Elaine Leong

**Title:** Reading Lazare Rivière in Early Modern England

**Abstract:** In the late 1630s, Lazare Rivière, professor at the University of Montpellier, delivered a series of lectures on practical medicine. Later, in response of requests from physicians writing from all over Europe, Rivière expanded these to include the theory of diseases and the resulting ‘Praxis medica cum theoria’ was printed in 1645. The work was hugely popular and translated into French and English. Peter Cole, the English printer of the work, claims that by 1663 over 1700 copies of the folio-sized tome had been sold. Moreover, the book did not only leap off the shelves of booksellers but was actually read. Surviving copies are often annotated and extracts from the work appear in contemporary medical notebooks. In bringing Rivière’s work to English audiences, Cole and his team made two crucial changes to the text. Firstly, in his preface, Cole specifically targeted ‘Ladies and Gentlewomen’ as potential purchasers and readers. Thus, bringing knowledge originating in the University setting into the domestic sphere. Secondly, later editions were often sold and bound with the English translation of Rivière’s ‘Observationes medicae’ (1646) so mixing the older practica with the new medical genre of observationes. Using analysis of marginal annotations and manuscript reading notes, this paper aims to explore how seventeenth-century English men and women read Rivière’s ‘Practica and Observationes’. In doing so, it seeks to understand the multiple instances of knowledge transfer, appropriation and codification which one text goes through as it makes it way from lecture halls to studies, closets and stillrooms.

**Author:** Christopher Leslie

**Title:** Polytechnic Penicillin: Innovation through Technology Transfer in the Context of Interdisciplinary Education

**Abstract:** Penicillin was discovered in 1928, but its use as an antibiotic was stymied by the difficulties of making it in mass quantities. Jasper Kane (who worked for Pfizer) developed a method using deep-tank fermentation in 1942. This had not previously been tried, but Kane's experience with using this method in 1936 for the manufacture of citric acid led him to this unique solution. With the hope to sponsoring innovation in the future, one rightfully wonders how someone would make this connection. Because Kane is a graduate of Brooklyn Polytechnic, the story resonates well with the philosophy of a polytechnic education: a tradition developed in the nineteenth century that demanded institutions with multiple disciplines of science and engineering that could be applied to industrial research. This story, then, offers important lessons regarding the potential for technology transfer when individuals are acquainted with a variety of disciplines and is an effective case study in how interdisciplinary was an effective method to sponsor innovation during the second industrial revolution. As discussed by Steven Shapin in The Scientific Life, the 1930s and 1940s were a period of transformation when scientists were called upon less to express a vocation and more to support a role. This story then supports Shapin's assertion that unexpected innovation did in fact occur in research labs. In addition, the story offers an important technology transfer lesson related to World War II, one that demonstrates the possibility of success under the enforced collaboration of big science.

**Author:** Anna Lindemann

**Title:** Freud’s psychopharmacological research in its scientific and medical environment (1884-1887)

**Abstract:** My talk is devoted to investigating Freud as a scientist with a specific interest in his scientific methodology, including: Freud’s objects of research in theoretical, methodical and therapeutic context; his basic assumptions and presuppositions and their origin and influence on observation and interpretation; Freud’s methods of observation and interpretation and his formation and modification of theory. By analysing and comparing Freud’s research with that of other
contemporary scientists I will shed light on the scientific programmes and communities which Freud entered with his writings on cocaine. I will also reveal the standards and manifestations of contemporary natural scientific and clinical research and aspects of Freud’s scientific practise, like originality, probity and handling of criticism. The discussion will address such issues as the connection between Freud and Wilhelm Wundt and Emil Kraepelin, who at the same time undertook psychopharmacological studies in Wundt’s laboratory and who, like Freud, modelled on Sigmund Exner. I will also examine the question of whether or not Freud was just a product of different scientific programmes, or did actually develop unique approaches in his scientific thinking and techniques. For example, what does Freud’s earliest theory of the mind reveal about Freud’s scientific connections and his own shift from nerve cells to the mind?

Author: Debra Lindsay

Title: “Barrier or Blessing? Evangelical Lutheranism, gender, and science: Maria Martin (1796–1863), a case study”

Abstract: Maria Martin (1796–1863) was an accomplished painter and naturalist from Charleston, S. C. Her botanicals and insects appeared in J.J. Audubon’s Birds of America (1830–1838), her snakes illustrated J.E. Holbrook’s North American Herpetology (1842), and her ability to move from scientific illustration to text-based research and description was crucial to the Quadrupeds of North America (Audubon and Bachman, 1846–1854). Working as both illustrator and researcher, she participated in a defining moment in the natural sciences (Blum, Picturing Nature, 1993): As an artist she participated in a long tradition of learning about nature through art; as a participant in the preparation of Quadrupeds, she was part of the shift towards text-based science. Moving away from a focus on important people, developments, and ideas, to analyses of less visible participants like Maria Martin reveals much about how individuals worked in the sciences, their ultimate effect, and the context of their endeavors. In this case, the role of a woman working behind the scenes is examined; ironically, in a world shaped by evangelical Lutheranism and Southern culture—or a place where patriarchy dictated place and position—Maria Martin was able to direct her talents towards science precisely because she believed in the dominant ideology. She believed women were destined to serve—both God and man—and she not only worked tirelessly on scientific projects for Audubon and Bachman, but she also commandeered others in her charge to do likewise.

Author: Erik Linstrum

Title: “Mental Health” after Empire: British Experts and the Postcolonial Personality

Abstract: Founded in 1948, the World Federation for Mental Health (WFMH) reflected postwar ambitions to prevent conflict by attacking the psychological roots of nationalism. Despite its internationalist rhetoric, however, the WFMH was dominated by Anglophone and especially British experts, including many veterans of imperial research. With its close links to the World Health Organization, UNESCO, and other international institutions, the Federation represents a neglected case study in the postcolonial afterlife of colonial knowledge. Drawing in part on the “attachment theory” of John Bowlby and his lesser-known counterparts in Africa, WFMH experts argued that modernization required an understanding of emotional dynamics in order to manage the people it was meant to help. Unconscious motives, childhood experiences, attitudes toward authority, and feelings about identity and change were, they claimed, decisive to the fate of international development programs. Thanks in part to the Cold War-era “special relationship,” British specialists in the science of mind won a prominent place on the world stage, offering advice on everything from African child-rearing to the hiring of employees in the U.S. State Department. An especially conspicuous mark of their influence was the 1954 publication, under the auspices of the World Health Organization, of J.C. Carothers’s The Psychology of Mau Mau. Carothers simultaneously justified a brutal counterinsurgency in Kenya and outlined the blueprint for a colonial welfare state — a juxtaposition which is often overlooked. By refashioning colonial ideas in the name of international order, British psychologists managed to retain global authority in a world where empire was ending.

Author: Melissa Lo

Title: Cartesianism, Chaos, and reductio ad absurdum: Gabriel Daniel's Voyage du monde de Descartes (1690) in an Age of Pictorial Reproduction

Abstract: This paper considers the woodcuts in a little book, Voyage du monde de Descartes (1690). In it, Jesuit priest Gabriel Daniel reproduced illustrations of vortices, circular motion, and magnetism from Descartes's Principia philosophiae (1644) and Le monde (1677) and then proceeded to lampoon them: such pictures became evidence of the Cartesian universe's "chaos", and their fantastic shapes reminiscent of Cyrano de Bergerac's L'Autre monde (1657). Daniel's text is often cited as anti- Cartesianism's last gasp in France because, by the time of its publication, the conservative Sorbonne had absorbed the
new philosophy into its curriculum. However, its visual strategies and pictorial surround have often gone unnoticed. To shift attention back to Daniel's pictures offers a means of understanding both the highly visual character of debates over Cartesianism and the polemics of pictorial reproduction towards the end of the seventeenth century. Indeed, in light of a visual culture already suffuse with pictorial demonstrations of Cartesianism -- including Jacques Rohault's Traité de physique (1671) and Bernard le Bovier de Fontenelle's Conservations sur la pluralité des mondes (1686) -- Père Daniel's repurposing of these images was rooted in the hope that visual deracination and rhetorical sting could overcome the increasingly widespread affirmation of Cartesianism's truths. The story I tell thus explores Daniel's ridicule as a reductive strategy that depended on the reuse of images, while also noting how such visual recapitulation served as a tool of epistemological recycling -- one that reinforced the very philosophy against which this Jesuit priest attempted to argue.

**Author:** Amanda Lourie

**Title:** Encounters and Exchanges in the Field between Men of Science and Aboriginal People in 1850s to 1860s Colonial Victoria.

**Abstract:** In 1854-1855, Prussian man of science, William Blandowski, undertook his second expedition within the colony of Victoria, Australia. This was his only expedition completed without Aboriginal assistance. The resulting expedition report saw a tentativeness in Blandowski’s observations not present in his other expeditionary reports. His natural history reporting depended on information exchange with local Aboriginal people. This paper will discuss encounters and exchanges of information between men of science and Aboriginal people through examining Blandowski and other men of science within 1850s-1860s colonial Victoria. The transfer of information during these encounters, its content and the motivations of the men of science and Aboriginal people will be examined, utilising spatial analysis, transnational intellectual genealogy and ethnographic epistemology and methodology. The incorporation of Aboriginal knowledge into natural history and anthropological knowledge, through challenging or adding to this knowledge will be discussed. In so doing this paper will explore the information left in the field and the information that crossed into broader scientific discourse. Whilst spatial analysis locates the exchanges within the colony of Victoria, the movement of scientific knowledge into, within and out of the colony of Victoria will expand the focus transnationally.

**Author:** Alan Love

**Title:** Physical Explanations of Developmental Phenomena in Flux, 1950-1990: The Life and Work of J.P. Trinkaus

**Abstract:** Physical explanations of ontogeny reached a zenith in the early 20th century through the work of D’Arcy Thompson. In On Growth and Form, Thompson fought the rising tide of genetic explanations: “it is…an exaggeration if we tend to neglect these direct physical and mechanical modes of causation altogether, and to see in the characters…merely the results of variation and of heredity.” But Thompson’s call was largely ignored and mathematico-physical approaches faded from view as experimental embryology metamorphosed in terms of the empirical success of molecular genetics. A NIH proposal review from the 1990s captured the sentiment succinctly: “The physics of how embryos change shape is neither an important nor an interesting question.” Now the situation is reversing, with Nature and Science routinely publishing papers detailing how physical processes, such as fluid flow, explain developmental phenomena. These studies didn’t arise de novo but grew out of a nurtured thread of research in the intervening period. This paper explores these years of flux (1950-1990) through the life and work of J.P. Trinkaus (1918-2003), a Yale embryologist who was a central figure advocating physical explanations of morphogenesis. Through an examination of his unpublished papers and correspondence, I demonstrate that his consistent presence at Marine Biological Laboratories in Woods Hole influenced the next generation of developmental biologists through direct mentoring (e.g., via summer embryology courses). This, in conjunction with other items, like his multi-edition textbook (Cells into organs: the forces that shape the embryo), meant the relevance of physical explanations was never forgotten.

**Author:** Paul Lucier

**Title:** Clarence King and the Transcontinental Railroad as Scientific Technology

**Abstract:** The first transcontinental railroad, completed in May 1869, changed the way Clarence King conducted his geological survey of the 40th Parallel -- the very route of the railroad. King had begun his survey in 1867 on the border of California and moved east into Nevada. But within two years, his plans to survey west-to-east were reversed. This paper examines the many ways in which King used the railroad and the many ways in which the technology changed King's science. For instance, the railroad allowed King to move personnel and equipment east-to-west into the field more rapidly and, for King, more conveniently. Equally important, the railroad allowed King to move specimens, numerous and large,
west-to-east out of the field. But the railroad was more than means of transportation and conveyance for King; it was the symbol and substance of modern society -- it not only condensed time and space, but helped King to organize, operate, extend, and advertise his expertise and experiences more quickly and efficiently. No better example of the manifold uses of this new technology can be found than King's famous discovery of a diamond hoax. The transcontinental railroad allowed King to figure out the location of the salted field, to expose the swindlers, and to make known to the nation King's own brilliance.

Author: Christopher Lyons

Title: Rooting a Wild Grass: Brachypodium, Model Organisms, and Green Energy

Abstract: In the late 20th century Arabidopsis thaliana (Arabidopsis) was chosen as the model organism for plant biology research. The decision of the community to work with, and financially support, research on one main organism fit well with the general broadening enthusiasm for the development of reductionistic, basic-science platforms. However, this “narrow but deep” tactic was not without its costs, as translational research from Arabidopsis to agricultural crop improvement was, and is still, lacking. In 2001, Brachypodium distachyon (Brachypodium) was proposed as a new model organism to meet the perceived gaps in basic and applied research for cereals, bioenergy crops, and forage grasses. Like Arabidopsis, Brachypodium has proven to have the essential features of a model organism—easily cultivated in the laboratory, a short seed-to-seed lifecycle, and a small genome. The goal of this paper is to explore the concept of the development of model organisms in light of the genomics and systems biology eras, with a particular focus on the unusual role of Brachypodium as a “new” model organism tasked with a specific goal of improving bioenergy grasses and cereal crops—a unusual event in the history of model building.

Author: Sherrie Lyons

Title: More than DNA: Daniel Mazia and the Importance of Cell Biology

Abstract: The spectacular success of genetic investigations culminating with the elucidation of the structure of DNA and how it carried out its function as the hereditary material has resulted in genetics dominating the thinking in understanding a variety of biological problems from evolution to cancer. Yet understanding the origin of forms and their functions has been resistant to this strictly genetic approach. Research in cell biology has demonstrated that morphogenesis is the result of multiple molecular interactions, many of which are not under the direct control of the genome. The cell biologist Daniel Mazia (1912-1996) was best known for his work explicating the structure of the mitotic apparatus as he investigated the general problem of cell reproduction. Mazia was concerned with understanding life at the most fundamental level and brought a deeply philosophical approach to his life in the laboratory. Although much of Mazia’s work involved identifying molecules that were critical to the various stages of cell division, he advocated the importance of microscopy believing that revealing the underlying structure of the cell would provide insight to development. New visualization methods have revealed much about cellular dynamics while at the same time raised complex issues about principles that underlie the cell organization and morphogenesis. In discussing some of Mazia’s ideas I argue that much can be learned from Mazia’s approach in furthering our understanding of life. Historians of science have largely ignored this more recent history of cell biology, which is a crucial aspect to the history of modern biology.

Author: Maria Elisa Maia

Title: Mach's Popular Scientific Lectures

Abstract: Mach’s Popular Scientific Lectures, a remarkable example of popularization of science literature, is a collection of lectures delivered by the eminent Austrian physicist Ernst Mach (1838-1916) in different occasions and over a long period, from 1864 to 1898. The 12 lectures that correspond to the period from 1864 to 1894 were separately published in German, collected and translated into English by T. J. McCormack and published in Chicago in 1895. A 2nd edition containing two more lectures and two articles followed in 1897. Finally the 3rd enlarged and revised edition, published in 1898, contains one extra lecture. All the translations were revised by Mach himself, who praised the quality of the translation. According to what Mach stated in the preface of the 1st edition, “Popular lectures …must select …easy subjects, and restrict themselves to the exposition of the simplest and the most essential points. Nevertheless, by an appropriate choice of the matter, the charm and the poetry of research can be conveyed by them.” The lectures of this collection that correspond to different periods of Mach’s life were intended for different purposes and present differences in style and content. Most of them deal with physics topics, but some have historical background and others present a philosophical character. In this communication we intend to present an overview of the Popular Scientific Lectures, focusing mainly on two of the lectures: “The Part Played by Accident in Invention and Discovery,” and “On the Economical Nature of Physical Inquiry”.

HSS 2013 Paper Abstracts
Author: Christine Manganaro

Title: Struggling Toward Stability: Human Ecology and the Nature of Colonial Development in Hawai‘i

Abstract: Beginning in the 1930s, social science began to serve as a naturalizing framework for American colonialism in Hawai‘i. University of Hawai‘i sociologist Andrew W. Lind advanced the idea that Hawai‘i's race relations were part of a natural, competitive process analogous to the workings of plant communities. Working in the sociological subfield of human ecology, which drew heavily from plant ecology, Lind combined economic history, the history of land use, and the study of race relations to conclude that the population of Hawai‘i was involved in a collective struggle toward social stability. He framed Hawai‘i's incorporation into the United States as the inevitable climax of modern social and economic development, arguing that the processes by which some groups (in this case racialized groups) become dominant was ostensibly natural – essentially organic – rather than intentional and historically contingent. In this way, Lind and fellow social scientists naturalized historically created social relations in Hawai‘i as well as American occupation of the islands.

Author: Chris Manias

Title: Building Baluchitherium: Imperial and International Networks in Early 20th Century Paleontology

Abstract: Between the years 1909 and 1936, the fragmentary remains of a huge prehistoric ungulate were unearthed in expeditions in India, Turkestan and Mongolia, and transported to metropolitan centers in London, Saint Petersburg and New York. The immense bones proved extremely difficult to interpret. Alternately terming the creature Baluchitherium, Indrichotherium, and Paraceratherium, paleontologists Clive Forster-Cooper, Alexei Borissiak and Henry Fairfield Osborn struggled over the reconstruction of this strange gigantic fossil rhinoceros, while nevertheless hailing it as the ‘largest mammal to walk the earth.’ Nonetheless, common work on the problematic animal served as a focus for collaboration and exchange rather than rivalry between scientific communities. Not only did the initial analysis of the animal depend upon pre-existing connections between British and American paleontological institutions, but the need for comparative material, recognition and contacts brought British and American scholars into communication with their counterparts in central and eastern Europe. The image which emerges – of scholars in the United States, Britain and the USSR attempting to solve a major paleontological problem, but constrained in many cases by variance in resources, differences in expertise and institutionalization, and difficulties of transport and communication – illustrate some of the drives but also the very practical dynamics of global scientific exchange in this period. The construction of the Baluchitherium, regarded as a nearly impossible scientific puzzle to realize and an overblown monstrosity as it was completed, shows both the extent and the difficulties which bedeviled this wide-ranging discipline even as it reached a great point of extension.

Author: Ry Marcattilio-McCracken

Title: “These Hindering Forces”: Intellectual and Cultural Foundations of Postwar Eugenics on the Southern Great Plains

Abstract: The history of eugenics in the United States after WWII has, over the last decade, seen a resurgence in the literature, yet it remains replete with unexamined themes, voices, and perspectives. Importantly, the Great Plains has been almost wholly neglected in our current understanding of the contours of the ideologies of American eugenics. Equally significant is the relative dearth of studies which recognize the persistence of the eugenics movement after 1945. This paper builds upon the recent work of scholars like Garland Allen and Gregg Mitman to interrogate the linkages between understandings of the environment, arguments for conservation, and assessments of the current quality of “human stock” and solutions for its future cultivation in the postwar years. It seeks to unearth a more holistic “scientific habit of mind” to which many subscribed and of which eugenics was a critical part. It brings together a diverse cast of characters from the national discourse like John Dewey, Gifford Pinchot, Robert Duffus, and Madison Grant as well as regional players like Aute Richards and James Marrs to construct a bridge between American eugenics in the first and second halves of the twentieth century. Such an approach can shed new light on the texture of discourse, and how ontological markers get attached as the result of cultural and intellectual trends. The construction of new epistemologies, especially with respect to eugenics after 1945, remains ineluctably rooted in notions of organized management and control of the biological world that current scholarship has yet to fully explore.
Author: Daniel Margocsy

Title: A Natural History of Satyrs: Myths and Exotica in the Age of Discoveries

Abstract: This talk examines how natural historians made a connection between Ancient fables and exotic animals in the Age of Discoveries. In recent years, historians have examined in detail how early modern naturalists used the techniques of humanist philology to identify the Greek species of Dioscorides and Theophrastus with local plants in their environs. Yet the scholarship has paid less attention to examining how naturalists also consulted myths, fables, and the poetic works of Virgil or Ovid to make sense of exotic plants and animals. Well into the eighteenth century, natural historians assumed that, poetic licence aside, these sources offered some factual evidence about real species. An expertise in natural history included the interpretive skill to tease out the difference between fact and fiction in literary works. This talk examines this skill through a case study of satyrs. A widely popular mythological figure, satyrs were frequently discussed in early modern natural history. While some claimed that satyrs were a human race, or the devil, most seventeenth and eighteenth-century naturalists claimed them to be the orangutang. Nicolaes Tulp, who first discussed the orangutang in European scholarship, named it a satyrus indicus, and Java and Borneo remained identified with the Islands of the Satyrs up to 1800. My account of the changing fortunes of the satyr thus contributes to the growing debate on how Europeans used Ancient knowledge to make sense of the New World in the Age of Discoveries.

Author: Petar Markovski

Title: Arnold Frutkin and the Rhetoric of Cooperation in Space: Transnational Networks of Space Exploration at NASA, 1959-1979

Abstract: When the National Aeronautics and Space Act was signed in 1958 by President Dwight Eisenhower, it had included in one of its provisions the ability for the new space agency to engage with other nations in collaborative projects for space exploration. In response, NASA appointed Arnold Frutkin to lead their International Programs Office the following year. Frutkin became an instrumental figure in NASA’s foreign relations policies, particularly for his efforts in the US-Soviet Apollo-Soyuz Test Project. Despite his contributions, historians have yet to sufficiently explore Frutkin’s real impact in the agency’s history. As a result, conventional histories of the Space Age have focused on competition among national programs to explain motivations for spaceflight. I argue that collaboration should also be understood as an important part of this historical narrative. This paper will explore the cooperative, transnational networks that NASA established as part of their larger mission of international cooperation in space exploration. I will situate this discussion around Frutkin’s correspondence, interviews and publications and analyze the rhetoric of cooperation that he created. I will argue that Frutkin’s rhetoric of international space cooperation achieved two goals: it helped to promote NASA’s overall international relations policy from 1959-1979 and it helped to shape the general transnational character and environment of cooperation in this period. My paper will draw upon concepts from the emerging field of transnational history, particularly those dealing with circulation and flows of ideas and knowledge and their role in the creation of a transnational environment for collaborative space exploration.

Author: John Marston

Title: Measured Relief: Coping with Floods and Social Differentiation in Rural Cambodia

Abstract: While there is not total scholarly consensus about it, the idea prevails that in Cambodia in the immediate post-independence period there was a rough equality among rural villagers. It is equally true that since UN-Sponsored elections in 1993 and the opening up of the Cambodian economy, any such village equality is disappearing. The paper will discuss the effects of massive flooding in fall, 2011, in a sub-district in Batheay, Kampong Cham province, an area which, compared to other parts of Cambodia, is particularly known for a range of individual and group strategies for dealing with water management. The paper describes the effects of flooding and different ways of coping on the village level. Although all villagers were devastated by the floods, the devastation was more lasting for some, whereas it was more of a temporary setback for others. Issues such as access to water for techniques of flood recession rice farming, ownership of water pumps, and ownership of irrigated land for dry season farming (with sources of water either communally or individually controlled) in the months following the flooding affected the degrees to which basic subsistence could be maintained. The paper will explore the implications of such variables and the degree to which climate change may be one factor in contributing to increasing social differentiation.
Author: Jennifer Martin

Title: Seeing Sharks: The Development of the U.S. Shark Tagging Program, 1960-1990

Abstract: In the summer of 1960, three shark bites along the Northeast coast so rattled the public that a group of marine scientists were prompted to conduct one of the first surveys of shark populations in local waters. When the researchers caught 311 sharks close to several popular beaches, including several white sharks over eight feet in length, scientists and members of the sport fishing community began a collaboration that would become one of the longest-running efforts to tag sharks in the wild. The program’s goal was to understand the abundance, migration, and distribution of these fishes along the Northeast and beyond. Building on earlier scholarship that has analyzed the histories of commercially-valuable marine animals, I suggest this tagging program was part of a larger shift in American thought regarding the appropriate ways of interacting with these creatures and, by extension, with the ocean itself. This paper examines the changing justifications, methodologies, and implications of the tagging program from its beginnings in the 1960s through the 1990s. Before the tagging program, the science of sharks was confined largely to anatomical and behavioral experimentation. Over the next three decades scientists and their allies would learn to see these creatures differently—in terms of their life histories, reproductive potential, and population dynamics. Based on archival sources and published work, my paper explains how scientists used the tagging program to understand the role of sharks in the ecology of the oceans and the limitations of marine science to shape U.S. policies with the seas.

Author: Rachel Mason Dentinger

Title: Patterns of Infection and Patterns of Evolution: How a Malaria Parasite Brought “Monkeys and Man” Closer Together in the 1960s

Abstract: For the first half of the 20th century, parasitologists struggled with their inability to infect other primates with human malarias, and vice versa. As a result, it was believed that primate malaria parasites were highly host-specific and, critically, that the malarias of “lower monkeys” did not threaten human health. But in May 1960, two scientists in a National Institutes of Health (NIH) laboratory were infected with a subspecies of Plasmodium cynomolgi, a malaria parasite isolated from macaques. Using mosquitoes to experimentally infect rhesus monkeys, the two researchers had taken no precautions to avoid bites themselves, wrongly assuming they were at no risk of contracting malaria. Soon enough, cases of both “accidental” and “natural” infections had demonstrated that “monkey malarias” could jump to human hosts. While ensuing discussions focused on implications for disease prevention, these infections also affected how researchers saw the distance between humans and other animals: “What we may have learned is that monkeys and man are more closely related than some of us wish to admit,” concluded NIH researcher Robert Coatney. This paper examines mid-century experimental infection of both humans and animals, and the categories used by parasitologists to understand host-parasite specificity. Historians have described a reciprocal traffic of concepts and material practices between medical and zoological research. This paper builds on that literature, arguing that evolutionary conceptions of human-animal relationships both changed and were changed by 20th-century parasitological experimentation.

Author: John Mathew

Title: The Siwalik Fossils and Early Contributions to Palaeontology from India

Abstract: In 1836, the nearly 40-year-old journal emanating from the Asiatic Society of Bengal in Calcutta, Asiatick Researches was marked by a remarkable surge of attention paid to natural history. The inclusion of so many articles on the subject reflected an extraordinary set of fossil findings in the Siwalik Range of Northern India and Nepal. The stream of communication on the subject had begun in the early 1830s – an English engineer, Proby Cautley, had unearthed a set of vertebrate fossils and wished to continue the quest. The communicator of the information to the Asiatic Society was the Scottish superintendent of the Botanical Gardens at Saharanpur, Hugh Falconer, who was soon closely involved with investigating the finds. By 1836, the Asiatick Researches had communicated articles relating each to the discovery of a fossil tiger, camel, hippopotamus, bear and ruminant, the last given to the name Sivatherium giganteum and now known to be a relative of the giraffes. It was not merely the discovery of this vast treasure trove of fossil mammals that occasioned attention; it was the analysis accruing from it at the hands of Cautley and Falconer that would firmly place the subcontinent in the annals of palaeontological research worldwide, not least for the suggestion that stasis for long stretches of time anticipated relatively short periods of rapid organic change, and that the massive Sivatherium shared anatomical features with both living ruminants and elephants, casting light on the possibility of common origins for them.
Author: Christina Matta

Title: Engineering Ethics - Beyond Failures

Abstract: I will discuss the place of history of science, technology, and medicine in teaching ethics - specifically in teaching engineering ethics. While failure studies have long been a highly popular and useful tool in teaching responsible decision-making and professional conduct for engineers, studying technology in its historical contexts can illustrate the need to consider contexts and implications beyond those related to safety and design.

Author: Seymour Mauskopf

Title: William Barlow and the Determination of Atomic Arrangement in Crystals

Abstract: The molecular theory of crystal structure developed in early nineteenth century France, and combined the molecular theory of crystal structure with the chemical atomic theory to elucidate the spatial arrangement of atoms in molecules. Initiated by André-Marie Ampère and developed by Auguste Laurent, its most significant result was Louis Pasteur’s study of optical activity and enantiomorphism in tartrate crystals. This tradition largely died out in the second half of the century, and crystallography became a largely abstract, mathematical enterprise. The development of structural chemistry was largely the work of German organic chemists, as so eloquently shown by Alan Rocke. However, towards the end of the century, a number of individuals attempted to resuscitate something like the earlier crystallographical-chemical program. One of the most interesting – and largely unstudied – persons was William Barlow (1845-1934), a self-taught scientific amateur. In 1883, he published his first major paper in Nature titled “Probable Nature of the Internal Symmetry of Crystals,” in which he argued that the form and symmetry of crystals can be explained by the close packing of atoms (having the shapes of spheres of spheroids) within the crystal. With William Jackson Pope, Barlow continued to develop his ideas over the next thirty-five years, and some of his models were adopted by the Braggs. In this paper, I shall detail the development and influence of Barlow’s atomic crystallographical-chemical models.

Author: Massimo Mazzotti

Title: Changing Order: Mathematical Life at the Fall of an Empire

Abstract: In this paper I shall explore some aspects of mathematical life in the city of Naples after the French occupation and the integration of the southern kingdom in the French imperial system (1806-1815). In particular, I’ll focus my attention on a popular textbook of descriptive geometry – a branch of geometry that was cultivated with particular fervor in that city. This book was first published in 1807, under the French government, and then republished in a deeply revised form in 1815, right after the restoration of the Bourbon monarchy. I shall argue that the second edition can be read as emblematic of a process of “return to order” in both mathematical and political life.

Author: W. Patrick McCray

Title: Astronomers, Sharing, and Data, 1965-1985

Abstract: Starting in the 1960s, astronomers’ view of the sky shifted from an analog perspective in which data was recorded using photographic plates and strip charts to one wholly mediated by digital technologies. Data management became one of the modern astronomers’ necessary tasks as astronomy itself transformed into a particular form of “information science.” This transition presaged today’s debates about Big Data and the archiving of massive data sets in astronomy and other sciences which researchers mine. This paper explores two episodes in this historical process using astronomy as an example. Both center around scientists’ intent to share data and data processing tools with their colleagues. The first episode concerns the emergence of the Flexible Image Transport System (FITS). This is a common data format developed by scientists at national observatories in the U.S. and Europe and accepted as an international standard in 1982. The second example is STARLINK, a sophisticated computer network for sharing image processing programs that debuted in the United Kingdom in 1980. In both cases, astronomers’ desire to share digital information speaks to broader changes in researchers’ moral economy as common data formats, standards, and other digital tools challenged traditional norms and practices.

Author: Lisa Messeri

Title: Lunar Geology and the Earth Analog
**Abstract:** During the Apollo program NASA astronauts had to learn quickly the basics of geology. They completed what might be best considered an M.S. in the subject as part of the training. Since there was no way to study the geology of the Moon per se, they extensively pursued analogue studies on Earth. This served well in preparing them work on the lunar surface. This paper explores the relationship of these analog studies, still used extensively in planetary science, and the pioneering nature of this work during the 1960s.

**Author:** Pierre-Olivier Méthot

**Title:** Epidemic Types, Changes in Virulence, and the Evolution of Host-Parasite Interactions: The ‘Transforming Principle’ of Fred Griffith in Historical Context

**Abstract:** By the 1920s the existence of immunologically distinct serological types of pneumococci was established. The apparent fixity of immunological types was however challenged soon by Frederick Griffith’s transforming experiment. His experiment (1928) proved that nonvirulent bacteria could be transformed into virulent types when mixed with previously heat-killed bacterial strains of a virulent type, and that those changes were heritable. Researchers at the Robert Koch Institute and the Rockefeller Institute promptly replicated the experiment and confirmed Griffith’s results. The latter, who died in 1941 during the war, did not live to see the demonstration that DNA was the ‘transforming principle’ as shown by Avery, MacLoed, and McCarthy in 1944. Fred Griffith is now mostly remembered for his discovery of transformation that ushered the development of molecular biology and the transforming experiment, retrospectively, looks like an oddity in the history of biology and medicine. As Joshua Lederberg reflected: ‘We are at loss trying to trace the intellectual influence behind his experiment’. The purpose of this paper will be to show that we can gain a better understanding of the origin of the transforming experiment by replacing it within the wider context of public health medicine and epidemiology, and particularly in the light of Griffith’s research on the specificity of host-parasite interactions. By focussing on Griffith’s work on Group A Streptococcus pyogenes, the agent of scarlet fever, a disease whose virulence was in decline, I show that the transforming experiment emerged at the intersection of bacteriology, evolution, and a form of medical parasitology.

**Author:** Sarah Milov

**Title:** Regulation

**Abstract:** When historians of capitalism turn toward lived experience, they tell stories about regulation. Once cast aside as the stuff of dusty administrative law textbooks, the history of regulation is being reborn as a forum for reassessing where state and society meet. Historians possess a unique methodological toolkit for rethinking and contextualizing the state-society binary implied by both public choice and critical theories of regulation. Using the historiography of tobacco as a case study, my comment will suggest specific sites for understanding the production of regulatory science with particular attention to the physical spaces where regulatory agencies and regulated actors meet, discuss and define their agendas—namely the land grant college and the Department of Agriculture. My comment will also explore how the history of science can help historians of economic life critically assess archives derived from industrial litigation, scientific advisory committees, and Daubert standard expertise. By helping scholars take a more nuanced view of knowledge-production, an STS-informed history of regulation can also open up more imaginative public conversations about the possibilities and limits to a discourse of regulation.

**Author:** Adriana Minor-Garcia

**Title:** Transnational Lives in Science? Manuel Sandoval Vallarta at the Crossroad of the US-Mexico Journey

**Abstract:** Mobility is a crucial attribute of transnationality in the life course of scientists. Scientists who embody various identities are able to produce knowledge by establishing connections among diverse cultural, disciplinary, and national worlds. In this process they accentuate and display different attributes adjusted to the context. This paper explores the potential of studying transnational phenomena through the professional trajectory of Manuel Sandoval Vallarta. He belonged to the Mexican elite, he was also a US trained theoretical physicist, a MIT professor, a promoter of Mexican and Latin American science in US institutions, a scientific diplomat for Mexico and the underdeveloped world in international organizations, and a leader of national science institutions in Mexico. My paper focuses on a decisive episode which illuminates the tensions between the different identities that defined Sandoval Vallarta’s career. In 1942, as President of the US Committee on Inter-American Scientific Publications, he started in Mexico a tour through Latin America to organize the Inter-American Academy of Sciences. Although he emphasized the importance of this project for US geopolitics, funds were suspended due to WWII priorities, and MIT urged him to return and resume his teaching duties. Sandoval Vallarta resigned
from MIT after the Mexican government offered him an especially tailored national institution for the encouragement of science. At this crossroad, Sandoval Vallarta’s life was confronted to a national and professional choice which not only determined on what side of the US-Mexico border he would henceforth work, but also the type of scientist he would be remembered for.

**Author:** Robert Mitchell

**Title:** Vital Media and Population Aesthetics

**Abstract:** In this presentation, I relate a "vital" concept of media to the modern concept of “population.” I argue that the modern concept of population--that is, the concept of population that emerged in the late eighteenth-century and which is still in force today--is intrinsically a media concept, for it assumes the notion of a sticky surface, or medium, that can capture variations and expose these variations to culling selective forces. I also argue that recognizing the relationship between media and population helps us to reconsider the nature of modern aesthetic experience, for (I argue) many twentieth-century modes of art and entertainment rely upon the enabling frame of population logic. Drawing on a series of examples, including professional sports, "noir" literary and cinematic narratives, and performance art, I seek to articulate the basic elements of population aesthetics, and the ways in which this latter concept can help inflect our understanding of biopolitics.

**Author:** Takuya Miyagawa

**Title:** From Colonial to Imperial: Typhoon Study in the Japanese Empire, 1890s-1930s

**Abstract:** From the late nineteenth century, European merchants, mariners, and missionaries in Japan began to investigate East Asian typhoon for safe voyage around the region as had started in Chinese treaty ports. For instance, Erwin Knipping, a German mariner who was hired by the Central Meteorological Observatory of Japan through the 1880s, started the research about typhoon and sent reports to German hydrological journal, which can be said European colonial science in Japan. But as following the rise of Japanese nationalism, overcoming coloniality in meteorology was one of the most urgent problems for Japanese meteorologists. They thought there would be the only way of achieving ‘independence’ from Europe: to find out the uniqueness in East Asian weather by making use of the imperial observation network constructed through the colonization of neighboring countries since the last decade of the nineteenth century. This paper will show how Japanese meteorologists tried to overcome coloniality and establish their own meteorology through typhoon study. For Japanese meteorologists, typhoon seemed the well-suited topic to prove the fact that storm of Far East was the distinctive phenomenon from general storms that European meteorologists had researched. By the profound analysis of typhoons, Japanese meteorologists argued that European storm model could not be fully applicable in explaining the structure of East Asian typhoon. This result brought them the recognition that they established ‘Japanese meteorology’ by 1930, which did not rely heavily on the meteorological theories from Europe to explain East Asian weather.

**Author:** Ken Mondschein

**Title:** The Science of Arms: Fencing Books as Vernacular Science

**Abstract:** From the early fourteenth century to the end of the seventeenth, the knowledge of how to use weapons in space and time — in other words, the skill of fencing — was set down in elaborate treatises, a considerable number of which survive today, and which may be sorted into several genres. Such works deployed contemporary ideas of physics, geometry, and mathematics to form coherent mimetic and pedagogical models for the teaching of a concrete skill. Fencing treatises form more than a sort of craft-knowledge, but also a means of diffusing ideas — one of the "trading zones" that Pamela O. Long so eloquently discusses. I shall thus be arguing for the fencing treatise not only as a means of intellectual diffusion, but also its place in the history of science.

**Author:** Iris Montero

**Title:** Mexica Evidence in the Spanish Court: Visual Thinking in a 1539 Inquisitorial Trial

**Abstract:** Eighteen years after the fall of Tenochtitlan by Cortés, an Inquisition investigation begun in Mexico City. Its purpose was to locate the idols taken from the temples of the city during the conquest, and still hidden by 1539. Two factors make this case particularly remarkable. Firstly, the case revolved around the very idol of Huitzilopochtli, the main tutelary deity of the Mexica (Aztecs), thought to have crowned the Templo Mayor of Tenochtitlan at the height of the empire. This was considered the most sacred material manifestation of Mexica religion before the fall of the city. And secondly, the charge
against the accused, an Indian called Taylotla who later took the Christian name of Miguel, was presented in the form of a painting on native fibre. This painting, which remains attached to the Inquisition file to this day, represented the trajectory of the idol of Huitzilopochtli from hand to hand since it was taken into custody on Moctezuma’s orders in 1521. This paper examines the role of visuality as a way of conveying valid evidence at court in the early days of inquisitorial practice in the New World. It pays special attention to the fluidity between Mexica and Spanish methods of inscribing evidence and to the juxtaposition of both visual and textual testimonies in constructing a case against native idol guardians.

Author: Jill Morawski

Title: Subject-Experimenter Relations in Postwar Psychology Experiments: THE CASE THE “BOGUS PIPELINE” TECHNIQUE

Abstract: Producing psychological knowledge involves elaborate organization of researchers, coordination across laboratories, and standardization of methods. A significant part of its scientific labor, though one often-overlooked in historical studies, is provided by experimental subjects whose participation as valid data producers depends on precisely executed, collaborative, and intimate work relations with experimenters. During the several decades following the Second World War, the assumption that experimental relations entail a straightforward division of labor between objective observers and obedient subjects came under scrutiny as experimenters apprehended problems with these collaborative relations that threatened the validity of scientific findings. One technical solution to the laboratory workplace problems was the “bogus pipeline” technique, the naming of which twinned the aim of faking subjects to believe a technology could detect their true thoughts with psychologists’ fantasy wish for a “pipeline to the soul”. The aspirations undergirding the bogus pipeline technique reveal how epistemic ideals were vested in creating social arrangements between experimenter and subjects that were distinct from those of everyday life. Yet at the same time its earliest applications to study race attitudes and pre-menstrual experiences relied on everyday social relations. The bogus pipeline represents one of numerous deception techniques ironically introduced during a period noted for a liberalization of civic life. Also ironic is the fact that these deception methods involved duplicitous, wizard-like performances of experimenters who, in turn, would prompt honest performances of subjects. Perhaps inadvertently, techniques such as the bogus pipeline informed subjects’ understanding of what it meant to “participate” in psychology experiments.

Author: Jan Mueggenburg

Title: Meeting Halfway: John C. Lilly’s Cybernetic Dolphin Experiments

Abstract: From 1955 until the late 1960s biophysicist John C. Lilly conducted a series of experiments to establish "interspecies-communication" between Man and Dolphin. While he started his experiments in a small laboratory in Florida, his research took on a whole new dimension when in 1959 Lilly established his Communication Research Institute on the shore of the Caribbean island St. Thomas. The institute’s laboratory consisted of a sea water tank, a "dry room" for experiments and a special "shallow water area", that connected the aquatic with the terrestrial environment and allowed men and dolphin to meet halfway. Or as Lilly put it: "Whether one likes it or not, one must go into the water to meet the dolphin." In my talk I will argue that John Lilly’s communication experiments can be read as an attempt to overcome the boundary between water and air by means of a heterogeneous set of media. These technologies were supposed to replace the glass panels of water tanks with a more permeable boundary without losing the benefits of controllability and isolation that were fundamental to his neobehaviorist experiments. I intend to show that the desired encounter between man and dolphin in the summer of ’65 was overdetermined by a "third kind": the (biological) computer as a speculative metaphor and open epistemic object served as a blueprint for Lilly’s research agenda and governed his ecological thinking.

Author: Samantha Muka

Title: Photographic Tanks and Underwater Cameras: Visual Technologies of Marine Taxonomy

Abstract: In 1941, William H. Longley posthumously published Systematic Catalogue of the Fishes of Tortugas. Longley performed much of the research for the taxonomic tome with a diving helmet and brass-encased underwater camera. He sought to alleviate one of the major problems of fish taxonomy: color recognition. When living and submerged, marine creatures display vibrant coloring and patterns; after death, many colors and patterns fade. Longley recorded fish coloration via direct observation in the marine environment and compared his observations with preserved specimens. While Longley’s work has been praised for his early use of diving helmets and cameras in marine research, little historical work has been done to place his studies in the larger context of marine taxonomy during this period. This paper examines technologies utilized in marine taxonomy between 1880 and 1950. Unlike terrestrial taxonomy, marine taxonomy often relied on viewing living or freshly killed specimens: the longer the specimen had been preserved, the less exact the identification. The problem of
specimen coloration forced scientists interested in accuracy to modify common laboratory equipment to extend the freshness of specimens, either by extending their life or preserving their coloration by alternate means. Utilizing archival and published sources and images by Alfred Goldsborough Mayer, William Beebe, and William Longley, I will trace the technologies taxonomists employed to observe and record accurate coloration. This paper seeks to highlight the highly technologized field of marine taxonomy and to link it to previous historical studies of technology and marine science.

Author: David Munns

Title: The Awe in which Biologists Hold Physicists: Phytotrons, Ecotrons, and the Definition of a Science of the Environment in the Early Cold War

Abstract: The Ecotron at Imperial College London is the most recent facility created by ecologists, botanists, and plant physiologists to study how organisms change in response to shifting environments. They are a small part of the efforts to predict and manage the biological consequences of shifting global and regional climates, as scientists now seek to understand how organisms respond morphologically, physiologically, and behaviorally to changes in their environments. Ecotrons can be traced back to an earlier and broader movement which used controlled environment laboratories known as ‘phytotrons.’ The first phytotron was built at Caltech in 1949, and the facilities spread rapidly to some thirty countries. Phytotronists advocated that biology needed to rigidly control the experimental space of the plant, to create reproducible organisms and experiments. In practice, by controlling the space, the phytotronists defined the “environment” in which organisms grew and developed as the physical parameters of climate, like temperature, humidity, light intensity, etc. Building on earlier work by breeders and geneticists to stabilize and control the genotypes of organisms, the phytotronists moved forward to the scientific study of the living organism by adding stable genes to known environments. In short, they said, “genotype + environment = phenotype.” This epistemic relationship defined the reality of most plant scientists’ working lives. In the early Cold War, the phytotronists enrolled modernist technology to control each part of the environment, and also actively fostered an international and interdisciplinary community to promote and legitimize their science.

Author: Heather Munro Prescott

Title: A Moonwalk for Women: The Women’s Health Initiative and Feminist Health Activism since the 1990s

Abstract: In 1991, NIH director Bernadine Healy unveiled what she called a “moonwalk for women”: the Women’s Health Initiative (WHI). The most ambitious clinical trial undertaken by NIH, the WHI was intended to be a fourteen-year, $625 million study of key health problems affecting older women, including prevention of breast cancer, heart disease, and osteoporosis. The WHI emerged after years of pressure from women activists in Congress, federal health agencies, and non-governmental feminist health organizations. Among the outcomes their efforts was the creation of the NIH Office of Research on Women’s Health (OWHR); and President George H.W. Bush’s appointment of Healy as the first female director of NIH. Londa Schiebinger has called these developments a “triumph for feminism,” but this paper will show that the reaction of feminist health activists at the time was more complex. The non-governmental feminist health organization the National Women’s Health Network saw the NIH’s increased attention to women’s health issues as a “victory.” Yet they expressed disappointment that the ORWH ignored the viewpoints of women consumers in setting the agenda for women’s health research. They were especially concerned that the WHI privileged the interests of medical researchers, clinicians, and the pharmaceutical industry at the expense of female patients. This paper will use the Network’s activism as an example of the role of feminist health organizations in shaping health research policy and biomedical knowledge production in the late twentieth and early twenty-first centuries.

Author: Jane Murphy

Title: Texts, Teachers, and Scholars: Studying the Sciences in 18th-Century Cairo

Abstract: This paper examines the manuscripts that were taught and studied, copied and commented upon, by scholars engaged in the gharib (‘less common’) sciences like mathematics, logic, astronomy, and divinatory arts in 18th-century Cairo. Using biographical dictionaries from the period as well as manuscripts in the gharib sciences and commentaries on such texts, I examine the chains connecting people to texts in the broader Islamic scholarly context seeking to understand the proliferation of manuscripts in these subjects from this period. This period has been dismissed as an ‘age of commentaries’ suggesting that little new or valuable work was produced. I suggest an alternate reading of both the commentary tradition and the new works produced in this period placing both in a social and intellectual context. I argue that authoring a commentary on an earlier work or another commentary (a supercommentary), functioned as a form of intellectual development and was also an effective means of attaching oneself to a prestigious author and text, and a significant cross-temporal community of
others linked to that same text and author. Additionally, I use case studies of individuals and manuscript traditions to highlight the intellectual and moral values such as verification and simplification in scholarly practice of the gharīb sciences. In conclusion, I examine criticisms of some of these practices at different historical moments, and what these attacks indicate about the popularity and course of the gharīb sciences over the 18th century and how the social standing of these fields shifted in the early 19th century.

**Author:** Edo N.W. van Veen

**Title:** The Early Years of the Electronic Computer as a Tool for Physicists: Exploring its Epistemological Potential

**Abstract:** Edo N.W. van Veen Radboud University Nijmegen, the Netherlands The rise of the electronic computer as an epistemic object within physics is reasonably well known: in the late forties and early fifties it evolved from a calculation tool to a generator of new problems. I argue that a new epistemic strategy for testing theories - the numerical experiment - was born around this time, because scientists set out to explore problems that were inspired by the instrument itself, as illustrated by a paper by Fermi, Pasta and Ulam. The development of the electronic computer started with the advent of the Second World War. Following its deployment on non-linear calculations for the atomic bomb, it became clear that the electronic computer could drastically speed up numerical processes for problem solving. In a 1955 paper by Fermi, Pasta and Ulam, an alternative approach was taken: instead of solving existing problems using numerical methods, they explored the possibilities of the new equipment by considering certain toy models. In so doing, they performed a pioneering numerical experiment; not only did they set the stage for modern computational physics - a discipline of contemporary physics that does not fit within the classical dichotomy between theoretical and experimental physics - they also caught a glimpse of an entirely new field of study in mathematics, now known as chaos theory. Placing this paper in a historical and epistemological context gives us insight in the way new technology is used within science.

**Author:** Carla Nappi

**Title:** Hoso hasa: Manchu Science and the Sound of Shaking Paper

**Abstract:** For historians of science and medicine, the history of translation is a history of sound. Sound itself was rendered in material terms, and from it emerged a number of other sonic objects in motion throughout the history of early modern bodies and their relationships in East and Central Eurasia: voice, breath, silence. Flapping grasshopper wings, hooves clacking on rock, donkeys braying, throats choking, arrows zhuzzzhing through air, leaves of paper shaking: in the rendering of Manchu texts about bodies and their norms by European- and Chinese-language speakers, these sounds and others were translated from ear to text and from language to language. The presentation will not only consider the significance of the Manchu language as a medium of translation of early modern science and medicine across Eurasia, but will also integrate an attention to the narrative potential of sound and musicality into the form of presentation itself. In doing so, the talk will offer an opportunity to consider how sound, silence, and musicality are not just narrative media in Manchu works about bodies, but are also important means of storytelling for historians of science considering those works.

**Author:** Latif Nasser

**Title:** The Great Divide, or how an Obscure Psychiatric Diagnosis from Colonial Africa Ended up in Playboy Magazine

**Abstract:** This is the story of the meteoric rise of an idea. An intellectual genealogy of a powerful way to explain human difference. The idea is easy to trace - in this case, through three works by three authors over three consecutive years, 1959-1961. In this grand game of broken telephone, though, the idea grows distorted: from the diagnosis of a single person to a sweeping narrative of all humanity; from a time- and place-specific observation to a timeless and universal gloss on social change; from the clinical language of a West African mental hospital to the pop-cultural metaphysics of Playboy magazine. What follows is the story of ‘the Great Divide.’

**Author:** Jaume Navarro

**Title:** Explaining the Demise of the Ether

**Abstract:** Historians of Science have paid much attention to the demise of the electromagnetic ether among professional physicists, with particular emphasis on the theoretical and mathematical work of the main actors in the formulation of the
new physics in the early decades of the twentieth century, recent historical work has led to the rejection of the old, but still popular thesis that michelson and moreley’s famous 1887 experiment with light interferometers acted as an experimentum crucis that almost instantaneously forced the abandonment of the ether (collins & pinch 1993, staley 2008). the ether remained alive for decades after that experiment, and we should think of the ether as something being abandoned rather than falsified. in this paper i want to explore the more than probable misunderstandings among less well-known scientists, science popularizers and secondary school teachers on what the abandonment of the ether really meant. on this matter, sentences like “what used to be called the ether but is now called the space”, that one often finds in popular books and articles in the 1920s and 1930s, show that the foundations of “classical” physics were so deeply engraved as common sense, that the explanatory power of the ether could not be so easily done away with, even by those who were actually explaining its abandonment.

**Author:** Elizabeth Neswald

**Title:** Measuring Metabolism

**Abstract:** This paper looks at questions of measurement in defining the approaches and methods of human metabolism research in the early twentieth century. A central concern of early metabolism researchers was how to deal with human and experimental variability and how to create commensurability across labs, instrument communities, ethnic groups and cultures. Metabolism research took place within a laboratory setting and was based on apparatus to measure respiratory exchange and measurement indices to assess basal metabolic norms, reductionistically expressed in the units of heat per kilo resp. square meter body surface area. Both apparatus and indices were in flux well into the twentieth-century. The tremendous variety of respiration apparatus in use created problems for comparing results and forced physiologists to explore and discuss procedures for establishing commensurability between the experimental set-ups and methods of different laboratories. Attempts to establish standard indices such as the height-weight correlation, the pelidisi index, and the body surface area law as predictive instruments and diagnostic tools collapsed in the 1920s, as studies on different ethnic groups indicated that the either the metabolic norms or the standard measurement indices were themselves ethnically specific. While measurement instruments were becoming increasingly precise, the object they were intended to measure – “normal metabolism” – became increasingly elusive.

**Author:** John Neu

**Title:** The Isis Bibliography, 1966-2000

**Abstract:** At the History of Science Society meeting in Toronto in 1966, the editorship of the Isis Critical Bibliography, previously the responsibility of the editor of Isis, passed to an independent editor. John Neu was appointed to that position, and remained editor until retirement in 2000. He remembers, as best he can, the history of the bibliography during those years.

**Author:** Peter Neushel

**Title:** Surf’s up…forever! In Wave Pools

**Abstract:** The crew of ABC’s Wide World of Sports showed up on the North Shore of Hawaii in the winter of ’72 ready to film a serious big wave competition. When they arrived, however, there were no waves. So they waited. And waited. Still no waves. Soon the novelty of a daiquiri on the lanai faded, and the crew returned to New York with no footage. World War II science fueled a revolution in technology that led to an exponential increase in the number of surfers, so many that there are not enough waves to go around. This led to the revival of an artificial environment—the wave pool. Wave pools and tanks date to the turn of the 20th century and have longstanding use for recreation and the study of hydrodynamics ranging from testing of ships, shore protection measures and oil platforms to measurement of vessel speed and bow-wave. Over the next fifty years science developed wave pools generating surf ranging from four to ten feet in size fulfilling some surfer’s dream of a chlorinated “Pipeline.” Endless waves in an arena may propel surfing into the ranks of spectator sports perhaps even the Olympics. But will the artifice of Post-War science and business ever truly challenge natural waves? Can a wave pool replicate the sand shaking thunder of 15-foot tubing wave at Pipeline? Perhaps not yet, but footage is guaranteed and the umbrella drinks are served poolside.

**Author:** Catherine Newell

**Title:** The Frontier and the Space Program: Situating Space in the Myth of Manifest Destiny
Abstract: The popularization of the science of space exploration in America after World War II has its roots in the
nineteenth century. Mid-twentieth century calls to “conquer” space were reanimations of nineteenth century exhortations to
“conquer” the American West in the name of God and to fulfill America’s manifest destiny. Magazine articles, television
specials, and films such as Destination Moon (1950) explicitly connected the ephemeral space frontier to the historical
western frontier. In each medium, “space proselytizers” like artist Chesley Bonestell, engineer Wernher von Braun, and
writer Willy Ley made clear connections between the American frontiersman of the previous century and the twentieth
century's space pioneer. This link is especially apparent in a series of articles on the emerging science of space exploration
that ran in Collier’s magazine from 1952 until 1954. Space is viewed as “our new frontier,” and is championed through
Bonestell’s paintings and von Braun’s invocation of the material frontier. Von Braun even closes his article by explaining
that Americans are ready for a journey to “man’s oldest and last frontier: the heavens themselves.” Thus, the science of space
exploration—in the Collier’s articles and elsewhere—was carefully framed as an endeavor analogous to the conquering of the
American West. By situating space as humankind’s “last frontier,” the effort required to build a space program could become
a moral endeavor and the fulfillment of America’s new manifest destiny.

Author: Antonine Nicoglou

Title: The Evolution of Phenotypic Plasticity: A New Perspective on the History of a Debate in Genetics

Abstract: In this presentation I will describe the context and the origin of a particular debate that concerns the evolution of
phenotypic plasticity. In 1965, British biologist Anthony Bradshaw proposed a widely-cited model intended to explain the
evolution of norms of reaction, based on his studies of plant populations. Bradshaw's model went beyond the notion of the
“adaptive norm of reaction” discussed by Theodosius Dobzhansky and I. I. Schmalhausen by suggesting that “plasticity” (the
ability of a phenotype to be modified by the environment) could be under direct genetic control. To prove Bradshaw’s
hypothesis, it became necessary for some authors to identify the pressures exerted by natural selection on phenotypic
plasticity in particular traits, and thus to analyse its evolution. In this presentation I will contrast two different views, based
on quantitative genetic models, proposed in the mid-1980s: Russell Lande and Sara Via’s conception of phenotypic plasticity,
which assumes that the evolution of plasticity is linked to the evolution of the plastic trait itself, and Samuel Scheiner and
Richard Lyman’s view, which assumes that the evolution of plasticity is independent from the evolution of the trait. I will
show how the origin of this specific debate, and different assumptions about the evolution of phenotypic plasticity, depended
on Bradshaw’s definition of plasticity and the context of quantitative genetics.

Author: Ilja Nieuwland

Title: The Double-Edged Spike: The Iconic Dinosaur Iguanodon as the Agent of Reconstruction and
Debate

Abstract: Iguanodon, discovered in 1822, was one of the first fossils that were recognized as something fundamentally
different from extant reptiles. Its cultural history is therefore tightly interwoven with the history of dinosaurs as a group. The
discovery, in 1878, of an entire herd of these dinosaurs in Belgium made it possible, for the first time, to study dinosaurs in
great detail. Also, Iguanodon turned out to have been a rather ‘generic’ dinosaur. For those reasons, the depiction of
Iguanodon in scientific art and reconstruction can be regarded as a pars pro toto for that of dinosaurs or even extinct animals
in general. Its appearance, metabolism, and anatomy could be used to consider general assumptions for dinosaurian anatomy.
This gave reconstructions of this particular animal a special significance, within the scientific world but also, as popular
interest in dinosaurs mounted, outside of it. This paper discusses three depictions, from different nations and scientific
backgrounds, of Iguanodon: one by the British artist Benjamin Waterhouse Hawkins from 1854, one from the Danish artist-
cum-paleontologist Gerhard Heilmann from 1916-1928, and finally a painting by Czech artist Zdenek Burian from 1950.
Each of these would cement a very specific attitude to dinosaurs and their world. Using these three examples, I will
demonstrate how art can on the one hand be highly effective in transmitting complex paleontological information in an
attractive and easy-to-understand format, but on the other hand generates its own artistic and scientific dynamic, which is
difficult to control.

Author: Lynn Nyhart

Title: Widening Our Professional Horizons: What Academics Can Do

Abstract: As president of HSS and a professor of history of science who advises graduate students, Lynn Nyhart has a strong
interest in the variety of careers outside the academy pursued by historians of science.
Author: Douglas O'Reagan

Title: Comparing French and British Efforts to Exploit German Science and Technology after WWII

Abstract: During the late stages of the Second World War and in the decade following it, the US, UK, France, and USSR each sought to utilize German science and technology for their own purposes. The Western three of these nations operated outwardly cooperative efforts throughout the invasion and in their occupation zones, and existing historiography generally attributes high value to these "intellectual reparations" taken by importing German scientific and technical personnel and materials. I focus here on the co-production of these programs and their diplomatic contexts in the 1940s-1950s in the UK and France, the two least-studied of the major powers involved in these efforts. Despite parallel agencies in these nations and other demonstrations of cooperation, these efforts were a small but significant source of diplomatic strain, much of which evolved from heightened perceived importance of science and technology to the state and differing concepts of the possibilities and limitations of technology transfer. French pessimism about tech transfer via importing technical personnel led to policies emphasizing 'control' through building joint Franco-German science institutes and using science trainees as intelligence agents, but was read by France's allies as cover for stealthy attempts to 'steal away' desirable Germans. British policymakers, meanwhile, fought an ongoing battle over which to prioritize: allying ever more closely with the United States, or exploiting a perceived opportunity to jump-start British export industries. For both France and Britain, conceptions of how to 'control' science and how to transfer technology shifted rapidly with the ongoing difficulties they experienced in Germany.

Author: Jason Oakes

Title: OFFICE WORK AND KNOWLEDGE OF LIFE: Gender and the Organization of Work at the Metropolitan Life Insurance Company and the Institute for Biological Research

Abstract: Mathematical biologist Alfred J. Lotka's main claim to scientific fame was his half of the name of the Lotka-Volterra equation, which described the dynamics of a two-species predator-prey interaction. What is less well known is that Lotka's single longest stretch of employment was actually with the Metropolitan Life Insurance Company of New York. While at Met. Life Lotka collaborated with vice-president Louis Dublin and continued to publish and work with biostatistician Raymond Pearl at Johns Hopkins University's Institute for Biological Research (IBR). Between the IBR's founding in 1925 and the beginning of the Second World War, Pearl, Lotka, and Dublin developed an approach to biostatistics that understood the behavior of a population to be a function of the aggregate qualities (length of life, rate of reproduction, incidence of injury) of the members of that population. But the knowledge of life produced by these institutions was also directly relevant to two highly gendered figures, the fertile woman's body, and the family wage owed to a bread-winning male worker. Moreover, the actual "laboratory" spaces in which these data were analyzed and produced at the IBR and at Met Life resembled each other in their gendered division of labor and their use of instruments and techniques for handling data and records, like punched-card tabulators and mechanical calculators.

Author: Brian Ogilvie

Title: Mapping the insect body: Pierre Lyonet’s anatomy of the goat moth caterpillar

Abstract: Pierre Lyonet’s “Traité anatomique de la chenille qui ronge le bois de saule” (1760), an anatomical study of the goat moth caterpillar, presented in painstaking detail the creature’s external and internal morphology. Like the investigations of Jan Swammerdam before him, Lyonet’s anatomizing required exquisitely fashioned tools, incredible dexterity, and keen eyesight. Few other observers in the middle of the eighteenth century had the ability to repeat his dissections, yet this did not prevent critics from accusing him of imposing his imagination on the caterpillar’s body. In this paper I consider how Lyonet’s eighteen engravings simultaneously represented and constituted his anatomical investigations. I consider his anatomical procedures, his process of transferring observations to illustrations and then to copperplate engravings, and the relationship between his images and the descriptive text. I then turn to how the reader was meant to imagine the two-dimensional illustrations in three-dimensional space, a process that Lyonet encouraged by his use of a coordinate grid system for relating the dissected corpse to the living animal. I conclude with an analysis of the rhetorical strategies that Lyonet used to convince viewers that the illustrations were the result of much hard work, but that nonetheless they were transparent windows onto what nature was really like.

Author: Kathryn Olesko

Title: Making Poland Prussian: Mapping the Polish Partitions and Reorganizing Polish Life
Abstract: The role of land measurement in Prussian state administration increased considerably in the second half of the eighteenth century as a result of territorial expansion following three Polish Partitions. Prussia’s size more than doubled, prior land ownership had to be certified, and reclaimed property distributed to German-speaking colonizers. The process was not an easy one. As the responsibility for property measurement shifted from private persons to state-certified surveyors, these surveyors had to deal with “heated disputes” over boundaries that could become “nasty”. The state regulation of measurement affected social and political change through the erosion of noble privilege, the transformation of the surveyor into an agent of state, the enhancement of state power by placing the execution of measurement under its jurisdiction, and the recognition of only state-certified measurements as legally binding. In addition, Prussian surveying was undertaken in conditions linked to long-held prejudices: the marginalization of Jews, the backwardness of Poles, and the identification of Polish lands with wilderness. Precise measures and geometrical grids were quite simply the means of control, integration, and standardization. This essay considers the degree to which surveying integrated former Polish lands both on paper and ideologically, and whether or not the surveying efforts undertaken before 1806, when Prussia lost to Napoleon, were of lasting impact after 1815 when Prussia regained most but not all of its eastern Polish provinces

Author: Allan Olley

Title: The Dawn of Celestial Mechanics at the JPL

Abstract: Since 1984 the Jet Propulsion Laboratory has been responsible for providing the values for the standard English language ephemerides detailing the predicted positions of major planets, the Moon and various other bodies. This marked a significant transition from the previous period when the national observatories of the United States and Great Britain had been responsible for supplying those values for over a hundred years. The requirements of the US space program led the JPL to develop these expertise quickly over the course of the 1960s. In this talk I will outline how the Jet Propulsion laboratory built on the work of traditional celestial mechanics to obtain the most accurate positions for the Moon. In particular I will examine how IBM researcher Wallace J. Eckert's work on lunar theory was incorporated into the JPL's program. I will also detail how the JPL quickly began taking up partial responsibility for calculating some values for the national ephemerides in the 1960s. I will also chronicle how by the end of the 1960s the JPL found traditional celestial mechanics wanting and began developing their own innovative program in celestial mechanics. The movement of the centre of calculation for celestial mechanics from national observatories to the JPL reflects not just the demands of the space program, nor the resources it commanded. The possibilities represented by the invention and adoption of the electronic computer also played a role in the shift.

Author: Robert K. Olson

Title: Style and Subject: Historiographical Trends through the Lens of the Isis Bibliography

Abstract: Changing historical styles, from “Whig” history to microhistory, have been well documented in the historiography of science. There has been less research, however, into trends in subject matter, particularly regarding varying interest in historical epochs. The author did an analysis of the chronological classification section in 136 Isis Critical/Current Bibliographies and found that the interest in premodern science has steadily declined over the last one hundred years in inverse relation to interest in modern science. Furthermore, when one groups publications into four broad epochal categories (premodern, early modern, nineteenth century, and twentieth century), one finds a successive interest in each epoch. The premodern era peaked in the 1920s, early modern publications in 1940s, nineteenth century publications in the 1980s, and twentieth century publications in the 2000s. Using this analysis as a starting point, this paper asks whether historiographical styles influenced these changing interests in historical periods. I argue that each epochal subject has been deeply informed by the historical style in vogue at the time of the subject’s peak.

Author: Lisa Onaga

Title: Predicting Disease and Sex in Silkworms

Abstract: In agricultural breeding programs, the separation of males from females has long held importance for the improved cultivation of livestock and poultry. The breeding of the domesticated silkworm is no exception. This paper examines a different facet to the story of breeding science and explores why and how sexing silkworms held particular importance for infectious disease control as well as predicting ways to enhance silk yields in late 19th/early 20th century Japan. The institutionalized sexing of silkworms that emerged from ongoing efforts to examine eggs for the presence of infectious microsporidia transmitted vertically from mother to offspring set the stage for reconfiguring the craft of breeding silk moths. The silkworms’ cocoons—the single raw silk fibers that protected the pupating larvae inside—also attracted the interest of breeders who believed male silkworm cocoons had higher silk content than egg-laying females. Associated with this
enthusiasm for predicting which cocooned specimens actually contained males, a number of creative instruments were prototyped to measure silk cocoons. This study of how scientists and cultivators developed methods of analysis by proxy to analyze the species — slides of mother moth smears to stand in as a predictive marker for silkworm health — cocoon size and shape as an indicator of sex — illustrates the reconfiguration of the domesticated silkworm as a utilitarian object beyond sex as an instrument for selective breeding alone. A history of the science of silkworm sex determination is woven throughout this paper.

Author: Eric Oosenbrug

Title: Hans Selye and the Selling of Stress

Abstract: Hans Selye is widely considered the ‘father of modern stress.’ His historic research on the General Adaptation Syndrome set the stage for the experimental study of the phenomena of stress and its relation to the etiology and experience of chronic illness. Selye’s physiological research, carried out primarily on laboratory rats, was translated beyond the specific contexts of medical clinics and distant battlefields into new sites of everyday life by advocating recommendations for social and moral behavior. This paper will explore Selye’s contribution to the promotion of stress as an ever-present danger, a threat to be managed, and a risk mitigated by the advice of medical experts and health professionals. As an internationally renowned endocrinologist, Selye adopted the role of a medical authority on life, understood in its dual meaning as both bios and ethos, through frequent public speaking events, magazine articles, popular books, and TV and radio appearances aimed at increasingly diverse audiences. In this paper, I will examine how Selye’s career, both as scientist and public intellectual, reveals the intermingling of scientific virtues, corporate interests, and imminent public health concerns in a postwar era characterized by the commercialization of health. Specifically, I will discuss some of Selye’s public relation strategies and the ways in which they both shaped and were shaped by private enterprise (such as the tobacco industry), by the development of individualized health management, and by an emerging therapeutic culture.

Author: Donald Opitz

Title: Ladies at the Lectern: Career Pathways in Horticultural Education among the British Isles, 1896-1906

Abstract: The rise of collegiate horticultural education among the British Isles in the 1890s constituted a new means for introducing young women to the sciences. This development also opened new career opportunities in teaching for scientifically-trained women. Such career pathways – all but omitted from the historiography of women in the sciences – raise a number of salient questions: How did formalized horticultural education promote a new field of employment for women, particularly in teaching? How receptive were educational institutions in employing these newly-trained women? What levels and kinds of scientific training did the women achieve? What scope of work did their teaching positions involve, and to what extent did they also undertake practical work and research? What was the character of the relationship between men and women at the institutions? And how influential were the institutions in propelling women students toward a full range of scientific careers? To crystallize such questions against a wider backdrop of women’s employment opportunities in the sciences, I will accentuate the career of Kate Barratt, D.Sc., botany demonstrator and lecturer, governor and, ultimately, principal at the Horticultural College in Swanley, Kent. The teaching career pathways of Barratt and her peers, draw our historical attention beyond “ladies in the laboratory” to account for the significance of “ladies at the lectern.”

Author: Carol Pal

Title: Information Factory: Samuel Hartlib and the Creation of Scientific Knowledge

Abstract: What did it mean to read or produce a work of scholarship in the seventeenth century? And how did the two processes differ? In the case of Samuel Hartlib, the answer is illuminating – because these two processes were blended into one. For example: In 1636, Jan Amos Comenius jotted down his ideas on universal knowledge, and sent a draft to a friend to get his advice. After months of silence, he received a box containing copies of a pamphlet – it was his own. In 1638, John Pell wrote a treatise on the methodizing of mathematical knowledge, but did not deem it ready for publication – so he sent it to a friend for advice. Soon, an anonymous tract began making the rounds. It was Pell's, and he was forced to reveal himself as its author. Comenius, Pell, and many others routinely sent material to this same friend, knowing that the fate of their words lay in his hands. That friend was the intelligencer Samuel Hartlib, whose network functioned as a production line for the swift creation of useful knowledge. He managed the process from stem to stern – he would pose a question and read the responses, then proceed to commenting, correcting, and translating, before finally blending chosen excerpts into new texts. Texts emerged from this information factory in multiple formats, bearing “Samuel Hartlib” as their corporate intellectual brand. This paper examines Hartlib as a special case of productive reading in the creation of scientific knowledge.
Author: Katharine Park

Title: Unsettling Boundaries II: East and West

Abstract: Taking as my departure work done for a course I co-teach with Ahmed Ragab and a textbook on the history of medieval science that we are co-writing, I will address the distortions that have been introduced by the near-universal tendency to present medieval Arabic science as 1) separate from; and 2) prior to medieval Latin science. This underpins a triumphalist and eurocentric narrative in which (in its baldest form) Arabic science acts primarily as a bridge between ancient Greek and medieval Latin science, going into decline as Latin science picks up steam, in a process that will culminate in the Scientific Revolution and the "birth of modern science" in early modern Europe, aka "the West." As I will argue, this narrative is deeply flawed: from at least the early eleventh century, "Eastern" and "Western" science developed in close communication and contact with each other in the shared spaces of the Mediterranean, and attempts to pull them apart have fundamentally distorted the historical record. Refocusing our attention on the ongoing engagement of the Arabic and Latin traditions, we present a new picture of medieval science as the product of a multicultural and interconnected world.

Author: Mina Park

Title: AIP's Selling Physics during the Great Depression

Abstract: The American Institute of Physics (AIP) was founded in 1931 as a loose association of five physical societies including American Physical Society. The original aim of the AIP was to achieve economies in the publishing of journals, but it soon broadened its boundaries and sought to legitimize physics’ contribution to American society during the Great Depression. The promotion of applied physics was one of AIP’s efforts for social legitimation of physics in 1930s. It was mainly targeted at industry to make industrial leaders recognize the value of physics in industry and to secure financial support and jobs from industry. AIP organized several conferences which advertised practical benefit to industry such as "Physics in Auto Industry." At the same time, AIP organized some conferences on applied physics, mainly to receive advices from leaders in industrial labs on problems of current education of physicists and necessary qualification for industrial physicists. In my paper, I will show that in highlighting benefic of physics to industry and discussing appropriate qualification of applied physicists, it exposed conflicting ideas among American physicists on the purpose of physics education for college students. It expressed tension between academic physics professors and industrial physicists, generation gap between classical physics and modern physics, and a changing balance between social need and discipline’s need. The tension, gap and changing balance were most clearly and sharply presented in how to teach physics students, what subject to teach, and what moral ethos to be built in college.

Author: Jessica Parr

Title: Treating the Emotionally Troubled En Masse: The Rise of Group Therapy and the Management of Obesity

Abstract: The 1950s and 60s witnessed an explosion in the number of mutual-aid groups that addressed a wide range of problems from excessive gambling to reducing fat. It was also during this period that 12-Step programs and the more commercial varieties of mutual-aid like Weight Watchers both experienced increased popularity and acceptance within American culture. This ‘self-help movement’ popularized the group approach to treating psychological conditions and the role emotions played in our overall welfare. Psychiatric attention in the possibilities of group therapy increased significantly during and after the Second World War with public health officials and general practitioners also showing interest in the group method to remedy psychosomatic illness and behavioural problems. The evolution of group therapy from a practice that had its origins in the military, to the civilian application in psychiatric hospitals and the diffusion of these techniques out into mutual-aid movements disseminated emotional therapeutic culture and language to a diverse population who self-medicated this form of psychological help often without any professional intervention . This paper looks at the rise of group therapy techniques and the post-war transference of these methods to lay administered weight loss groups in the United States.

Author: Anne-Sandrine Paumier

Title: Laurent Schwartz and the Collective Life of Mathematics: The Case of the Mathematical Seminar in Postwar France
**Abstract:** It is well-known that the mathematical community rapidly grew just after the Second World War. This numerical increase corresponded to a deep transformation in the organization of the mathematical life, which became newly collectively-structured. In dealing with this transformation in my PhD dissertation, entitled "Laurent Schwartz (1915-2002) et la vie collective des mathématiques," through a biographical path. Although it may seem strange at first sight to use a single case to deal with collective aspects of life, this choice can easily be justified. Schwartz is a good witness because he goes through the right period. But he is above all a good probe, as he takes part in the construction of different collectives. In this talk, I will take the example of the mathematical seminar. When Schwartz entered the Ecole Normale Supérieure in 1934, there existed in Paris only two seminars: the international tribune "séminaire Hadamard," and the closed "séminaire Julia." In 1968, some thirty mathematical seminars took place each week around Paris. Schwartz is a complete actor---creator, speaker and listener---with respect to the different mathematical seminars in this very period.

**Author:** Emily Pawley

**Title:** “Experiments all for Worldly Gain”: Profit and Knowledge making in Nineteenth Century American Agriculture

**Abstract:** In the hustling world of agricultural improvement during the first half of the nineteenth century, almost all knowledge-makers had a direct stake in the landscapes and organisms they described. Pomologists sold apple trees and promoted silk; agricultural chemists peddled patent fertilizer; authorities on pure breeding had pure blood cattle for sale; and agricultural geologists inflated speculative bubbles in land. The agricultural journals themselves, in fact were often published out of agricultural warehouses, which often doubled as museums. In the rapidly-commercializing cultivated landscape, profit and knowledge-making were inextricably intertwined. This combination of interests meant that improvement was, like most antebellum American marketplaces, awash with accusations of fraud, swindling, and counterfeit. However, this paper will argue, such accusations led not to a separation from profit and the development of a “pure” science” but to a form of knowledge where lack of market involvement was seen as decreasing credibility of the speaker. Anxious to rid themselves of charges of “theory,” improvers expressed their expertise and practicality in published books of accounts, in lists of printed prices, in analytical estimates of nutritional value, and in tests of competing goods conducted before audiences of hundreds of thousands. By examining experiments “for worldly gain” this paper will illuminate new intersections between knowledge of the cultivated landscape and the volatile and shifting markets of the early nineteenth century, intersections that shaped both the science and the landscapes that followed.

**Author:** Rachel Pear

**Title:** Religion and Science at the Sidelines: American Modern Orthodox Jews’ Encounter with Darwinism in the 20th Century

**Abstract:** Recently a challenge has been issued to amend and supplement current research on the history of science and religion that has largely been based on the study of Christian engagement with Darwinism (e.g. Numbers in Dixon et al 2010). This paper takes up this challenge and looks at how one minority group’s encounter with Darwinism relates to the historical and sociological trends that have been identified by historian of science Ronald Numbers as having taken place over the course of the past century regarding Christianity’s relationship with science: naturalization, privatization, secularization, globalization, and radicalization. This paper will argue that the story of American Orthodox Jews relationship with Darwinism over this same period supports some of these developments, but offers amendments to others. For instance it argues that Orthodox Jews have gone through a process of becoming more public, rather than more private, about their religious commitments over the past century. At the same time this group has not necessarily become radicalized, but has rather championed what in their view is a moderate position that blends the appreciation, and even glorification, of Western science with commitment to traditional religion. It is hoped that this look to the periphery will broaden the picture considered by historians of science and religion and be helpful in progressing to a fuller understanding of the dynamics at play in the public understanding of Darwinism-- an issue that has clearly become fundamental to the ways in which religion, science and identity have become intertwined in contemporary America.

**Author:** Jacob Pearce

**Title:** The Cosmic Microwave Background: Reshaping the Conceptual Space of Modern Cosmology

**Abstract:** The discovery of the Cosmic Microwave Background Radiation (CMB) by Penzias and Wilson in 1964 was heralded as proof of Big Bang theory. It was also termed the final ‘nail in the coffin’ for the Steady State research program. This paper will examine the role of the CMB qua epistemic entity in re-shaping the conceptual space of modern cosmology—the landscape of possible styles of reasoning (as posited by Hacking) and scenes of inquiry (as used by Jardine). The CMB
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The value of the CMB was far more than as evidence for a theory. Rather, it made the case for observationally driven cosmology. This moment in 20th century cosmology signified a turning point, whereby observational evidence became the decisive factor for both consolidating and generating lines of inquiry. What the CMB symbolically represented for the style of reasoning—withstanding the lasting effect this epistemic object had on shifting the trajectory of the conceptual space of cosmology—is far more significant than its relation to theory choice. The CMB buried Steady State, so to speak, because of the style it legitimated, rather than due to its epistemic content. Tracing the history of the notion of the CMB further highlights the contingent 1964 interpretation, and calls into question the role of this entity in epistemic practices and strategies in cosmology today.

**Author:** Jennifer Pegg

**Title:** William Herschel’s Speculative Cosmology: Hypotheses and the Modest Natural Historian of the Heavens

**Abstract:** Between 1783 and 1818 the English astronomer William Herschel (1738-1822) presented a series of papers on the “construction of the heavens” at the Royal Society. These works of speculative cosmology moved dramatically beyond the boundaries of contemporary astronomy, which concerned itself largely with the solar system – treating the stars as mostly static entities and nebulae as mysterious oddities. Herschel, by contrast, argued that stars and nebulae changed over time, even though he could not observe any processes of change directly. William’s speculations skirted the edge of acceptable English natural philosophical practice, whose community of practitioners endorsed the epistemologically modest posture embodied in Newton’s famous maxim: “hypothesis non fingo.” In deliberate contrast to Newton, one of Herschel’s favorite exclamations in the company of family and close friends was “hypotheses fingo” (“venture hypotheses”). This paper examines Herschel’s strategic efforts to justify his speculative cosmology while trying to cultivate a reputation for himself as a modest, moderate natural philosopher. Central to this project was a conscious effort to position his work within the boundaries of acceptable natural philosophy. Toward this end, he embraced the rhetoric of Newtonian non-fingo’ing in public (if not in private), situated his work within existing natural historical practice, and presented his approach as the most moderate natural philosophy of all: a mix of observation and theory defined by nature herself, hedged on either side by the twin dangers of isolated fact and pure speculation.

**Author:** Erick Peirson

**Title:** Plasticity, stability, and yield: the agricultural dimensions of Anthony David Bradshaw's model of adaptive phenotypic plasticity

**Abstract:** British plant ecologist Anthony Bradshaw's writings in the mid-1960s are widely considered a keystone of discourse among evolutionary ecologists about the evolution of phenotypic plasticity -- the ability of an organism to respond morphologically, physiologically, or behaviorally to changes in its environment. Yet those same writings were also influential among plant breeders concerned with problems of genotype-environment interaction. Previous research has shown how Bradshaw's earliest experiments in the mid-1950s concerning plasticity in plants were rooted in the conceptual and institutional framework of post-war British agriculture. But it was not until a sabbatical year in the early 1960s at the University of California, Davis, that Bradshaw set out his ideas in print. Drawing on newly available archival materials, oral histories, and the published record, I will describe how Bradshaw's experimental and theoretical work on adaptive phenotypic plasticity in plants synthesized the British agricultural practice of genecology, controversial notions of developmental stability from cytogenetics, and the methodological and theoretical tools of agro-ecological population genetics in California. I will also describe how Bradshaw's ideas about adaptive phenotypic plasticity were tied to a dramatic reconceptualization of the temporal and spatial scales of evolutionary change, a core component of the emerging field of evolutionary population ecology in the 1960s. Bradshaw's research and ideas concerning adaptive phenotypic plasticity provides a valuable lens into the complex interrelationships between evolutionary ecology and the political, economic, and technical dimensions of post-war British and U.S. agriculture.

**Author:** Stephen Pemberton

**Title:** When Iatrogenesis Pervades Innovation: Hemophilia Management in the Age of Genetic Medicine

**Abstract:** Iatrogenic (medically-induced) illness is a common revenge effect of the physician’s best efforts to advance clinical medicine as a scientific enterprise. To illustrate the complexities of iatrogenesis in their relation to biomedical
innovation and clinical practice, this talk focuses on advances in genetic medicine surrounding hemophilia management from the 1980s to the present. Hemophilia became a readily manageable disease after clotting factor concentrates derived from human blood plasma brought significant improvements to the lives of people with hemophilia in the 1970s. Yet, the 1980s and 1990s witnessed the catastrophic consequences of this widely reported “therapeutic revolution” as most consumers of clotting factor concentrates acquired HIV-AIDS and hepatitis C from these treatments. While this “iatrogenic catastrophe” has been well covered by historians, little scholarly attention has been paid to those historical actors who remained committed throughout this crisis to advancing innovative treatments for hemophilia in their resolute quest for “cures.” This talk details the emergence of recombinant DNA clotting factor concentrates in the 1990s as the new standard of front-line hemophilia treatment as well as growing investments in gene therapy research from the same era that have recently been shown in ongoing clinical trials to control bleeding in hemophilia B patients. The paper thus explains how the genetic turn by frontline hemophilia researchers and their supporters over the past two decades has become a powerful, albeit problematic theme in the global hemophilia community’s struggle to remain committed to scientific and medical progress in the wake of a major iatrogenic catastrophe.

Author: Peter Pesic

Title: Max Planck’s Cosmic Harmonium

Abstract: In 1893, Max Planck, newly appointed professor of physics in Berlin, was seconded to study the department’s Eitz harmonium, capable of dividing an octave into 104 steps. An accomplished musician, Planck learned to play this new instrument and used it to devise experiments in musical temperament, the only experiments he ever conducted in a career devoted to theoretical work. Planck’s “experiments” consisted of short musical compositions testing whether or not singers would revert to “natural” (just) tuning as opposed to the equal-tempered scale in common use. His surprising results contradicted his expectations and those of his teacher Hermann von Helmholz: the habit of equal temperament was stronger than the pull of “natural” temperament. The following year (1894), the “black year” of German physics, left Planck the only surviving professor in his department through the premature deaths of Heinrich Hertz and August Kundt. Planck then turned to the problem of blackbody radiation, for which his musical experiments prepared him by alerting him to the power of habitual assumptions as well as by providing him the detailed example of a harmonium with tunable resonators, comparable to Hertzian oscillators. The modes of electromagnetic waves in a cavity have many analogies with the problems of tuning and temperament Planck had just studied. His investigations of universal “natural” temperament led directly to his work proposing a new “natural” tuning of atomic resonators, from which Planck drew the consequence of a truly universal “natural” system of cosmic units.

Author: Alexander Petersen

Title: Being Ethical in Large-Team Science: A Quantitative Historical Perspective

Abstract: Since the middle of the twentieth century, science has increasingly become a large-team endeavor. The gradual crowding out of singleton and small-team science further challenge key features of the scientific system, such as assignment of recognition, incentives to collaborate and share, and the moral responsibility of the scientist. In a system dominated by large teams, it becomes increasingly difficult to fairly distribute rewards, such as the recognition of precedence, financial funding, and career achievement prizes. It becomes equally difficult to assign blame: Who is to be held responsible in ethical breaches, and who is responsible for monitoring and enforcing the ethical standards in a system composed of large groups? And, since science groups now span various scientific domains, is it conceivable to apply a universal set of ethical standards to scientific endeavors of all sizes and all disciplines? To make things worse, the hierarchical structure of large teams in the making of science strengthens the stratification mechanisms, which distinguish the “haves” and “have-nots.” Using expository analysis of historical publication datasets to quantify the growth of team size and the distribution of scientific achievement, I discuss the potential effects of large-team science on ethical issues. I also tackle the question of whether or not the ethics in singleton and small-team science is relevant to the understanding of the ethics in large-team science. My analysis renders quantitative support and complements qualitative analysis that has been ongoing in history of science.

Author: Heather Peterson

Title: Saving Appearances: Heredity and the Microcosm of New Spain at the Turn of the Seventeenth Century

Abstract: At the turn of the seventeenth century, Juan de Cárdenas, Enrico Martínez and Diego de Cisneros re-imagined the generation of man, arguing that creoles (a term relating to the children of Spaniards born in the New World) inherited their parents' essential choleric nature. Though seemingly novel, this construction represents continuity as much as change. For
while these authors challenged man's relationship to place and parent, articulating the first theory of heredity, they did so primarily to reify ideas about the degenerate nature of New Spain and the cosmic supremacy of Spain. In a sense their innovation functioned much like Ptolemy’s epicycles, which "saved appearances," explaining the visible discrepancies in the geo-centric model. Rather than overturn ideas about environment and place that privileged Europeans, these authors came up with a theory that would save appearances, explaining why the offspring of Spaniards did not resemble the Indians though they shared the same stars, air and water. Just as Copernicus and Galileo clung to the notion of the perfect sphere these authors held onto ideas about peripheral monstrosity and man as microcosm. Spanish cholera, Indian phlegm, and African melancholy were products of what Martínez termed the "universal machine" of the world. Creole inheritance did not challenge the structure of this machinery; it merely provided a mechanism for understanding slight deviations.

Author: Marissa Petrou
Title: Recycling Skulls, Reducing Exoticism: Drawing the Line between Physical and Cultural Anthropology in Imperial Germany
Abstract: Imperial German anthropologists were a bit obsessed with human skulls. They traveled for them, collected them, created new instruments to measure, represent and display them. During his field research in Asia-Pacific, A. B. Meyer bought them whenever he could, and robbed them from graves when he couldn't. A few years later, his collection of skulls helped land this young independent scholar the directorship of Dresden's new Museum for Zoology, Anthropology and Ethnology (ZAEM). In this paper, I trace the trajectory of how skulls were recycled from physical to cultural anthropology in the publications and museum displays of the ZAEM. I argue that the practices developed around recycling these objects ultimately resulted in a reduction of exoticism. Physical anthropologists looked for physical differences in human specimens and explained those differences as evidence of racial difference. Through new imaging techniques Meyer revealed that many physical differences could be found within one race and that some of those differences could instead be explained by socio-cultural practices. He rejected the scientific usefulness of ahistorical craniometric procedures in favor of new perspectival methods of skull representation to examine indigenous practices in treating the living and the dead. The process of flattening the object was a process of unveiling the knowledge held in the three-dimensional form. Its success as an ethnographic tool was through the production of multiple representations that could train the eye. I look at how this tension between reduction and proliferation was employed to draw the line between physical and cultural anthropology.

Author: Sarah Pfatteicher
Title: Engaging Engineers
Abstract: In 2011, Dr. Pfatteicher was part of an interdisciplinary team (with a sociologist and a civil engineer) that developed a certificate (akin to an undergraduate minor) focused on science and technology studies and designed for engineering and science majors. The Integrated Studies in Science, Engineering, and Society (ISSuES) Certificate enables students to design their own curriculum of humanities and social science courses to complement their major. The first students have begun to graduate, and this talk will touch on assessment data as well as the logistics of combining an interest in history of science with the constraints of an undergraduate STEM major.

Author: Jeff Pooley
Title: “A Not Particularly Felicitous Phrase”: A History of the “Behavioral Sciences” Label
Abstract: In the early 1950s, many American social scientists began to call themselves “behavioral scientists.” The rapid uptake of the label was the result of the Ford Foundation’s 1951 decision to name its social science division the “Behavioral Sciences Program.” With Ford’s encouragement, the term was widely adopted by quantitative social scientists eager to access the foundation’s social science initiative. The label’s newness and its link to the gigantic foundation’s well-funded initiative generated much suspicion and resistance as well. This paper reconstructs the label’s career from scattered interwar use through to Ford’s embrace. Existing histories trace the term back to psychologist James G. Miller’s Committee on the Behavioral Sciences at the University of Chicago. The term, however, was already in limited circulation by the mid-1930s, deployed in distinct but overlapping ways by philosopher of science Charles Morris, political scientist Arthur Bentley, and psychologist Clark Hull. Drawing on Ford, Yale, and Chicago archives, the paper traces connections between Hull, Miller, and Hull student Donald Marquis, who played a pivotal role as the key social science planner at Ford. For Marquis, the label was a layabout alternative, an encumbrance-free near-neologism that could, on the one hand, avoid the recurrent conflation of “social science” with “socialism” by anti-New Dealers in Congress, but also signal a linguistic break with the speculative, unscientific legacy that allegedly remained a drag on social scientific progress. The term quickly became a flash-point around which clashing visions of postwar social science were organized.
Author: Scott Prinster

Title: The Queen dethroned? The Changing Role of Biblical Knowledge in Nineteenth- And Early Twentieth-Century American Science

Abstract: One particularly important foundation in the western development of scientific knowledge has been the biblical worldview. More than simply providing the foil against which science has rebelled, the accounts of nature contained in the Hebrew and Christian Scriptures coexisted with and informed the empirical exploration of nature, and the systematic study of these texts was celebrated by some as “the Queen of the Sciences.” However, the status and authority of the biblical accounts shifted in the nineteenth century as new scientific truths came to light, and as biblical studies itself adopted an explicitly “scientific” approach. This paper will explore how both advocates and opponents of the new biblical criticism in the United States claimed scientific status for their positions, and how their efforts helped to shift the boundaries of legitimately “scientific” knowledge.

Author: Valentina Pugliano

Title: Shop natural history: the conversable and convivial science of the Renaissance pharmacy

Abstract: In this paper I will introduce an important site of scientific discussion and experimentation of the Renaissance that has received little attention so far: the pharmacy shop. Italian pharmacies have begun to be studied for their importance not only in the medical but also in the political and social dynamic of the Renaissance town. Physicians were attached to specific shops and spent hours there daily; gentlemen regularly visited for a chat on current affairs; artisans met there after work to play chess and discuss religion. Focusing on Venice and Verona, where pharmacies were established centres of sociability and where several apothecaries interested in the study of nature were based, I will show how this ferment held true also for the natural historical context. While we are more familiar with the written production of early modern natural history, there was a whole dimension to it which, if not collective in aims, was premised on off-paper socialization and oral exchange, foregrounding the eighteenth-century science of coffeehouses and salons. As an aspect of this dimension, the pharmacy shop constituted an important arena for Renaissance naturalists: offering at once a repository of naturalia, a testing room with useful equipment, and a meeting place for like-minded individuals to converse and learn about nature that was intrinsically more accessible than other emerging sites such as laboratories and curiosity cabinets. The average shop, I will argue, could become a reference point for local sympathisers of natural history attracted by the prospect of doing science leisurely and ‘together’.

Author: Joanna Radin

Title: Off the Rez: How Indigenous Bodies Became “Big Data”

Abstract: This paper examines intersecting histories of big data and postcolonial biomedicine, with an emphasis on the relationship between situated bodies and seemingly mobile information. I focus, in particular, on how health information about the Pima Indians of the American Southwest has become a dataset now used by statisticians as well as genome scientists. The former are interested not in the content of that data, but its quantitative complexity. In other words, as Pima data moved off the reservation it has become available for new and unexpected uses in basic informatics research. The Pima Gila River Indian Community was created as a reservation in the 1850s. A century later epidemiologists began sustained investigation of the health status of its residents. The political boundaries of the reservation functioned to emplace the Pima, making them appear as a natural laboratory in which to study issues of chronic illness, most notably diabetes. This work was undertaken against the backdrop of the International Biological Program (1964-1974), a worldwide effort to sample and archive genetic data from human communities understood to be geographically isolated and in danger of disappearing. I situate the fate of Pima-related data, the accumulation of which was enabled by the legacies of American settler colonialism, within a broader discussion about the history and ethics of indigenous peoples in postcolonial technoscience. In doing so, I examine the limits of alienability and the persistence of place and personhood in the history of big data.

Author: Joanna Radin

Title: Labor

Abstract: The question of labor is one of mutual interest to historians of science and of capitalism. In this comment I am especially interested in the potential for feminist and postcolonial perspectives to open new avenues for conceptualizing who
and what counts as a labor force for science, as well as for capitalism. For instance, recent scholarship in STS and history of biomedicine has begun to interpret participation in clinical trials, reproductive medicine, and tissue economies as forms of "clinical labor" – prompting a reconsideration of Marxist theories of value and alienation. What is the relationship between labor and work? Who and what are the entities that maintain economies, technoscientific and otherwise? Thinking expansively about labor at the nexus of science and capitalism may reveal new kinds relationships of care as well as forms of violence.

**Author:** Ahmed Ragab

**Title:** Unsettling Boundaries I: Premodern and Modern

**Abstract:** Dividing history of science, knowledge and technology into modern and premodern relied not only on presumed temporal boundaries but also on perceived qualitative differences that rendered “premodern science” intrinsically and inherently different and illegible to “modern” science and sensibilities. Here, experiments and experimentation are some of the important practices that are perceived to have conditioned this boundary. However, this view overlooks important scientific and technological practices in medieval and premodern science that involved active “experimentation”. From experimenta and empirica in medicine, testing wounds and techniques in surgery, observation programs in astronomy and astrology, to collecting data in geography and cartography and using archeological artifacts for historiography, medieval and premodern scholars and practitioners developed epistemic structures located in the experienced, the observed and the local and interacted with the “theoretical” and universal. In this paper, I will analyze the place of experimentation and observation in the making of medieval and premodern scientific thought and practice and will argue that the temporal division “modern/premodern” needs to be revised and revisited to allow for a deeper historical inquiry into the development of scientific thought and practice; expanding our field of inquiry and the types of sources that we rely on for our historiography. This paper is part of a larger research project connected to a course on medieval sciences that Professor Katharine Park and I are co-teaching and a book that we are co-authoring on the subject.

**Author:** Evan Ragland

**Title:** Transmuting Mechanism: Mechanical Ideals and the Chymistry of Life in the Work of Franciscus Dele Boë Sylvius

**Abstract:** One of the most popular teaching physicians in the seventeenth century, Franciscus Dele Boë Sylvius (1614-1672) presents a paradoxical philosophy of living things. While articulating a reductive mechanistic ideal of bodies along with all natural changes, he resisted and ridiculed extant mechanistic offerings of vital phenomena. In this paper, I explore the background and context of Sylvius’s mechanistic ideal, and use his deep reading and practice of chymistry to that his working methods and concepts remained materialistic, but constructed from the active properties and complexities of chymistry. Sylvius abandoned the teleological, active work of Helmontian archei and Aristotelian ensouled atoms in favor of chymical affinities he could observe in the laboratory. Transmutation, too, appears as a frequent explanatory tool in his accounts of the generation and transformation of bodily substances. Qualitative changes remained largely inexplicable under the strict Cartesian mechanism propounded by others in Leiden, and endorsed as Sylvius’s own ideal. Yet it was just such qualitative changes that remained essential to the practice of medicine, and for which chymistry offered productive explanations and tools for investigation. Finally, I compare Sylvius to his students and contemporaries, such as Reinier de Graaff, Thomas Willis, and Robert Boyle, to get a better sense of what the chymistry of life meant in some key places in the mid-seventeenth century.

**Author:** Chitra Ramalingam

**Title:** Inventing Photography, Inventing Science: Early Histories of a New Medium in Britain, 1839-1851

**Abstract:** The newly invented medium of photography was first made public in an era marked by intense controversies about the nature of scientific discovery and invention, and about how the histories of discovery and invention should be told. This paper explores the earliest historical writing on photography in Britain, through a survey of a wide range of popular and technical periodicals in which early "histories of the art" and commentaries on patent and priority disputes were published. These first histories of the medium—which was widely described as both an art and a science, an invention and a discovery—were crucial in constructing a durable origin story for photography, but they also participated in contemporaneous shifts in historical writing about discovery, invention, genius, technology, and a unified ‘Science’ in the nineteenth century.
Author: Christina Ramos

Title: Making a Spanish Bedlam in the New World: Madness and Colonization in Colonial Mexico

Abstract: In 1567, a penitent conquistador named Bernardino Alvarez founded the Hospital de San Hipólito in Mexico City. Although the hospital was originally intended for convalescents, it also accommodated the poor mentally ill and gradually came to offer its services to these individuals exclusively. Yet, in spite its prominent status as the first mental hospital of the Americas, the Hospital de San Hipólito is never mentioned in the literature on madness and its institutionalization, which has concentrated overwhelmingly on European developments. Citing both hospital records and two seventeenth-century biographies of the hospital’s founder, this presentation discusses the origins of New Spain’s first mental hospital. Broadly, I argue that the hospital’s establishment and early development was not only unique and unprecedented, but predicated more on colonial processes and imperatives than any European antecedent. I pursue this claim in the following ways. First, I consider how the evangelical climate of the sixteenth century shaped Alvarez’s heroic career and fostered the rise of charitable institutions like the Hospital de San Hipólito. Second, I document how the hospital’s expansive charitable services, including but certainly not limited to the care of the mentally ill, helped to sustain Spanish settlement in the Americas. Finally, I examine how the hospital reproduced existing racial and class hierarchies, both in its multiracial patient population and its recruitment of indigenous and slave labor. In this way, my analysis of the Hospital de San Hipólito’s colonial foundations helps to broaden the scope of existing narratives of madness and its institutional “confinement.”

Author: L. Ruth Rand

Title: Earth Under Glass: Ecological and Ecocultural Mimesis at the Biosphere 2

Abstract: In September 1991, eight people began a two-year stay inside an enormous sealed greenhouse called the Biosphere 2. Project organizers sought to determine if miniature versions of the Earth—Biosphere 1—could be constructed and sustained by human managers. In popular literature, the structure was also called a “glass ark,” suggesting that a Biosphere 2, on Earth or elsewhere, could serve as a replacement for Biosphere 1 in the event of ecological disaster—testing the feasibility of extraterrestrial colonization was a major, if understated, goal of the project. In essence, the Biosphere 2 was an experiment in internal planetary mimesis: making here like there in preparation for making there like here. This paper examines how those who built Biosphere 2 approached the monumental task of recreating not one ecosystem but an entire planetary order within a single enclosed structure. Setting aside the question of whether the controversial project constituted a success or failure in creating a small-scale Earth, I focus on how generalist ecologists, under economic and social pressures generated by the unique administrative structure of the project, determined the most essential attributes of Earthliness—from energy flows and soil composition to the parameters of biodiversity. Through close analysis of personal accounts by crewmembers and project planners, as well as my own four-month experience at the site, I seek to uncover which mimetic processes were deemed necessary for mechanical ecological sustenance, and which were necessary on an aesthetic or perceptive level, in order to replicate an Earth under glass.

Author: Alisha Rankin

Title: Authenticity, Alchemy, and "Earth" in Early Modern Pharmacy

Abstract: This paper examines the changing and disputed definitions of terra sigillata, a popular poison antidote and cure-all, in the course of the fifteenth through eighteenth centuries. For over a thousand years, the term "terra sigillata" had referred to a clay that was excavated with much ceremony on the island of Lemnos and formed into medallions with a seal to guarantee authenticity. From the late fifteenth century, however, newly discovered "earths" in Europe began to compete with the original Lemnian variety, and "terra sigillata" became a category of drugs rather than a specific drug from a specific place. The different varieties all retained the medallion shape, and each kind of terra sigillata had its own seal. Although the seal was supposed to guarantee authenticity, disputes abounded. The changing definition of the drug underwent a further shift in the late sixteenth century, when a German alchemist called his chemically produced drug "terra sigillata" - shaped into the same medallion form as the other varieties, but no longer a clay. Very soon thereafter, an alchemist working for Duke Friedrich I of Württemberg drew a sketch of an oven to be used to produce "terra sigillata," by which he meant the philosopher's stone. This paper probes the way the consistent form of the drug - a medallion with a seal - made it easier for the term "terra sigillata" to be applied to drugs of various different compositions, some of which had nothing to do with "earth."

Author: Joy Rankin
Title: A Personal “Computer Revolution”: Achieving Widespread Interactive College Computing 1963-1968

Abstract: A special correspondent for Nature reported about Hanover, New Hampshire, “The newest status symbol in this isolated university town, best known for the success or at least the roughness of its football team, is the possession of a personal computer console – something on which to work in the evenings and something on which the children can do their homework.”** This Nature article dated from 1966, describing the interactive time-sharing system implemented at Dartmouth College; the system’s numerous teletypewriter terminals provided users with the experience of a “personal computer,” as Nature declared. This paper explores the cultivation of a computing culture on a liberal arts campus in the 1960s. The men who spearheaded the time-sharing project, John Kemeny and Thomas Kurtz, mathematics professors, convinced the college’s administrators and trustees to invest in computing for the campus. In fact, their commitment to creating a computing culture that maximized ease and accessibility for as many users as possible set them apart, at a time when the norm was maximizing the output of a particular machine and focusing on users in the sciences and engineering. I argue that Kemeny and Kurtz realized their vision of widespread computing by developing both a user-oriented time-sharing system and an easy-to-learn programming language (Beginners’ All-Purpose Symbolic Instruction Code, or BASIC). Moreover, I contend, they developed a framework for embedding those technologies: the requirement that all students enrolled in first-year math courses learn BASIC. This paper analyzes the lectures, assignments, and grading programs developed to nurture computing exploration.

Author: Renee Raphael

Title: Doing math with Galileo: Marginal annotations in extant copies of his 'Two New Sciences'

Abstract: This contribution examines how contemporary readers approached Galileo’s 1638 'Two New Sciences', a text which contains Galileo’s well-known findings on the motion of falling and projectile bodies. It focuses on a selection of extant annotated copies of the 'Two New Sciences' identified by the paper’s author as part of an ongoing census of extant copies of the first and second editions of the text. By analyzing how these (largely anonymous) readers responded to Galileo’s diagrams and mathematical proofs, it shows that Galileo’s text (even its most mathematical and ‘straight-forward’ sections) elicited no fixed response. Rather, period readers embraced a variety of techniques—from drawing new diagrams to developing their own shorthand notation to editing and extending Galileo’s demonstrations—as they followed along with Galileo’s reasoning. Some used Galileo’s text as a mathematical exercise book, treating his proofs as a collection of problems to be worked through. Others instead saw his text as an exercise book for the application of new mathematical techniques, notably the new methods of analytic algebra. These findings corroborate what historians of reading have found for other genres and periods—namely that the meaning of a text is not fixed on the page, but varies depending on the training and assumptions of the reader—even as it goes beyond to show how readers worked through a text which exhorted its readers to pick up a pen and compass and follow along with its author.

Author: Jessica Ratcliff

Title: The Acquisitive Sciences: “Humboldtian” Science within World History

Abstract: This paper is a preliminary attempt to connect the historiography of science to recent debates in world history. It brings together: 1) analyses of the rise of “Humboldtian” science and 2) the Great Divergence debate. Both of these are concerned with developments in Europe between 1750 and 1850. In the economically oriented Great Divergence debate, science is characterized as an “endogenous” factor internal to European culture, as opposed to “exogenous” factors such as global commerce. I show that, on a material level, the growth of so-called Humboldtian Science was co-extensive with the growth of global commerce and European imperial expansion. Thus the growth of science in this period should not be understood as a purely endogenous development. I suggest considering instead how the expansion of European global presence changed patterns of data and information consumption within many of the sciences in the period. Just as the increasing European consumption of foreign goods may have sparked the “industrious revolution,” so too, perhaps, was much of the “second scientific revolution” kindled by the period’s increasingly acquisitive scientific practices. From this perspective, modern science in Europe is given a more material and a more externally-contingent place within world history.

Author: Sandra Rebok

Title: Impact of Humboldtian Science in the United States during the 19th Century

Abstract: After Alexander von Humboldt’s visit to the United States in spring 1804, for the rest of his life he maintained a
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strong communication with its political and scientific elite and exhibited a vivid interest in the further development of this country and particularly its progress in the sciences. This paper explores the connections of Humboldt within the North American scientific community on the one hand, and on the other, his impact on the development on different scientific disciplines in the U.S., due to his growing fame over years. For example, H. D. Thoreau classified New England’s climate zones according to Humboldt’s model of plant ecology and also the zoologist L. Agassiz was a protégé of the Prussian. Furthermore, he had a notable influence on North American geographers as well as on the landscape painters of the Hudson River School. F. E. Church, the most prominent member of this school, traveled together with the painter G. Catlin to South America to see the places and peoples Humboldt had described in his works. Finally, Humboldt’s accounts of his journey through Spanish America also inspired a generation of explorers who were setting out to survey the American West. The aim of this presentation is to analyze the impact of Humboldt’s scientific model on the process of the launching of modern American science in the 19th century and to explore how his methods were followed and continued by others.

Author: Emily Redman

Title: Making the Grade: Quantification, Measurement, and Assessment in U.S. Precollege Mathematics Education

Abstract: The historical patterns of reform of mathematics education in the United States are decidedly linked with the changing social, political, and intellectual environment of the nation. This interconnectedness renders the history of such reforms highly contextual and, accordingly, the attempts to assess the effectiveness of these efforts must be understood in a similar frame of reference. This paper explores the use of comparative data employed to assess various K-12 mathematics curriculum reform efforts through three main data regimes: the testing of curricula for effectiveness, international comparisons of test scores, and longitudinal assessments of student performance over time. While efforts at curricular assessment have been attempted for over a century, interest in data collection and quantification of assessment dramatically increases in the post-new-math era; this paper will trace the evolution and practice of data collection from the early 20th century to the present. Rather than assuming these data sets quantify curricula and student performance with value neutrality, this paper placed measurements against a backdrop of competing agency, social pressures, and state and federal politics.

Author: Brian Regal

Title: Richard Owen and the End of Monster Studies

Abstract: The scholarly engagement with monstrous creatures goes back to antiquity. From Aristotle to Pliny to Gesner, Aldrovandi, to even Charles Darwin, naturalists found monstrous creatures, human and animal, confirmed and mythical, as subjects worthy of serious study. Abnormal and unusual creatures were thought to be able to give insight into questions of generation and transmutation. The attempt to explain mythical creatures—to make the fictive real—drew much scholarly attention, but also helped put an end to the pursuit of such creatures by scientists. By the late 20th and early 21st century the study of monstrous creatures had shifted from the world of scientists to the realm of amateur investigators. What accounts for the transition from legitimate scientific enterprise to fringe activity? The work of Victorian naturalist Richard Owen can be taken as a watershed moment in monster studies. His research into and public comments on sea serpents, particularly his debunking of the HMS Daedalus incident of 1848, marks the beginning of the end for monster studies. I will recount the work of Owen on sea serpents and how it contributed to the retreat of mainstream science from a previously legitimate field.

Author: Brianna Rego

Title: Researcher, Life Sciences Foundation

Abstract: Following the discovery of antibiotics in the mid-twentieth century, infectious disease ceased to be a leading cause of death in industrialized nations. With bacterial infections seemingly eliminated, the pharmaceutical industry redirected its resources toward an emerging and potentially much more profitable problem: chronic disease. This therapeutic shift has been well documented in the historical and scientific literature. What has been largely overlooked, however, is the extent to which established pharmaceutical companies subsequently neglected further research and development of antibiotics. Concern about antibiotic resistance was noted in the mid-twentieth century, but did not garner much attention among physicians and public health professionals in the United States until the 1990s. This paper details how decades of disregard by the pharmaceutical industry resulted in a dearth of new antibiotics even as they were becoming increasingly necessary. In the 1990s, the new biotech industry—comprised mostly of small-scale startups—confronted the antibiotic problem, and with novel solutions. The smaller and more innovative corporate environment of biotech resulted in research approaches that broke the Big Pharma mold. This paper ultimately argues that this turn away from the traditional pharmaceutical industry’s chemical approaches to
drug discovery and development, and toward the biological approaches of biotech marks another fundamental shift in the history of medical science.

**Author:** Lynnette Regouby

**Title:** Saffron Fields and Naval Hospitals: Tending Bodies from the Outside In

**Abstract:** In 1728, Duhamel du Monceau earned his entry into the Académie des Sciences by uncovering the cause of la mort, a parasitic plant spreading through the soil between saffron bulbs in the field. This double function of the environment – as sustainer of health and conduit of disease – inspired Duhamel to devote a lifetime of research segregating out factors in the environment and their specific effects on plant and human life. While debates raged in other circles about reproduction and classification, Duhamel focused on growth and decay, aggregating a list of influences (light, water, temperature, etc.) that constituted a local environment and whose effects – once known – might be attenuated. Duhamel applied this experimental knowledge of environmental effects to improve the health of precious plant and human bodies. He advised how to manage the shipboard conditions for the transportation of plants; likewise, he advocated for the proper ventilation of ships and hospitals to accommodate the needs of human bodies for fresh air. For Duhamel, what was required to sustain plant and human health was a clear understanding of a particular body’s unique physiological principles linking it to certain factors in the environment as well as an understanding of how that environment could be modified through technology or better practices to accommodate that body’s needs. Managing the proper fit between bodies and environments became, for Duhamel, the key to health and disease: for crops in the field, for grain in the bin, for sailors at sea.

**Author:** Michael Reidy

**Title:** Mountaineering and the Body Aesthetic in Victorian Britain

**Abstract:** John Tyndall was both a prolific scientist and a pioneering alpinist. As a lecturer at the Royal Institution, he helped define the aim and scope of science in the Victorian era. As an alpinist, he helped establish mountaineering as an acceptable sport. He combined these two pursuits throughout his life, transforming mountains and glaciers into scientific laboratories. This paper will uncover the complex manner in which he incorporated gendered notions into his scientific mountaineering as a means to establish his own authority. Tyndall rarely climbed alone. Rather, he worked closely with J. J. Bennen, a professional guide, and later with his wife Louisa. He wrote extensively on his scientific research undertaken with Bennen and he built a summer home with Louisa in the Pennine Alps overlooking the Aletsch glacier, the main “laboratory” for his glacier studies. While Tyndall defined his own authority by contrasting his work from both Louisa (representing the feminine) and his guide (representing the primitive), he did so through the common medium of his own body. This ranged from emotional self-control (through heroism, rationality, and courage) to more tactile physical control (through bodily privations, exertions, and self-experimentation). Thus, this paper will extend previous research, which has focused on the creation of middle-class notions of masculinity arising from a differentiation from a feminine and the working classes, to demonstrate that in Tyndall’s science and alpinism his own authority relied on a complex set of notions about what it meant to be “masculine.”

**Author:** Miriam Rich

**Title:** The Civilized Uterus: Race and the Pain of Childbirth in Early Nineteenth-Century American Obstetrics

**Abstract:** This paper examines how the uterus was read as a locus of racial difference in nineteenth-century obstetrics, and the ways in which this expert knowledge was deployed to justify therapeutic intervention. It explores the ubiquitous nineteenth-century concept that civilized white women experienced much greater pain in childbirth than did their nonwhite counterparts, focusing specifically on the theories of early nineteenth-century physician William Dewees. Dewees, known as a founder of American obstetrics, located the explanation for racialized parturient pain in racial differences of the uterus. By anchoring pain and difference in an organ of the medicalized body, Dewees both underwrote a therapeutic mandate for obstetric intervention, and situated the physician as an arbiter of racial boundaries. According to Dewees’ theory, civilization caused the atrophy of uterine muscular fibers, resulting in painful childbirth for civilized white women. By claiming that uncivilized women in their “natural” state did not experience pain in birth, Dewees was able to argue that parturient pain was a pathological rather than a physiological phenomenon, and thus that obstetric intervention was mandated to alleviate it. Dewees advocated bloodletting to fulfill this mandated intervention, a therapy that elevated the status and perceived expertise of the male obstetrician at the expense of lay female childbirth attendants. Furthermore, by positioning an organ of the body as a marker of human social difference, Dewees moved towards a physicalized, anatomical concept of race. Lessons about both therapeutics and race were thus read from the uterus and, by extension, the medicalized body.
Author: Joan Richards

Title: ‘The kernel of the history of culture’: Mathematics in the Victorian world

Abstract: In The Study of the History of Mathematics, George Sarton trumpeted the history of mathematics as “the kernel of the history of culture.” The history he then elaborated was an “esoteric” study accessible only “to a select group of initiates;” the “account of a [progressive] development taking place mysteriously in the darkness” behind more obvious histories of war and of peace. Sarton’s vision of historians of mathematics pursuing “in the darkness, secretly, the fulfillment of their intellectual desires and of humanity’s highest purpose” was formed in a world just about to plunge into the darkness of World War II. Contending that ours is a different age, this paper will carry Sarton’s ringing phrase into the history of nineteenth-century mathematics in an attempt to reconsider its implications for present understandings both of mathematics and of culture.

Author: Linda Richards

Title: On the Beach: Speculative Fact and Fiction in Health Physics

Abstract: Trust in the ability of scientific experts such as health physicists to provide radiation health safety has been central to the expansion and acceptance of nuclear technology. There is much to be learned from the different interpretations of radiation dangers by scientists and the public, such as mothers and fathers who wrote letters of concern to Linus Pauling, who became a radiation safety expert as an opponent to all war. In particular, within the field of health physics, one interpretation of radiation danger dominated during the Cold War: that artificial radiation below natural background levels was safe and acceptable. This paper will reflect upon the construction of background radiation as “safe” as a speculative process that continues to be interpreted as fact by scientists, the nuclear industry, press, the public, and government officials. Willard Libby, chair of the Atomic Energy Commission, assured the public of nuclear weapons tests fallout safety while Linus Pauling framed the exposure to radiation by mass populations as experiments that were conducted without consent. This paper uses the 1959 film On the Beach as a fulcrum to illustrate the relationship between these two scientists, politics, ethics, and knowledge production in the late 1950s. The example relates health physicists to acts of policy making and the public exclusion involved in the institutionalization of the ideology of background safety worldwide by the AEC and IAEA.

Author: Lukas Rieppel

Title: The Ontological Assemblage of Fossil Dinosaurs

Abstract: The ontology of fossil dinosaurs is surprisingly complex. The dinosaurs we are accustomed to seeing at the museum are a kind of chimera. On the one hand, the morphology, functional anatomy, and behavioral ecology of these creatures evolved over millions of years. But the elaborate, freestanding fossil displays invoked by the word “dinosaur” are also produced by the museum’s preparation lab. Among other things, they usually consist of fossil bones from multiple individuals that have been subjected to intense curatorial intervention. Because they are a product of nature that has undergone extensive manipulation, dinosaurs destabilize the nature/culture divide, providing a rich site to examine how ontology and epistemology interact in the production of new objects of science. I will examine how fossil dinosaurs were assembled into a freestanding display at the American Museum of Natural History around the turn of the 20th century. Dinosaurs are distinguished from most other objects of science in part because they are also a mass public spectacle: the very same object served a research purpose while simultaneously communicating to a broader public. Because the American Museum was committed to performing the epistemic virtue of mechanical objectivity, it was crucial that its dinosaur displays were more than mere products of human ingenuity. Thus, although a great deal of imagination was required to turn a jumble of disarticulated fossils into a vivid and life-like display, museum curators consistently downplayed the dinosaur’s chimerical status, choosing to highlight the material link that united fossil and the distant past instead.

Author: Lukas Rieppel

Title: Philanthropy

Abstract: Historians often characterize the rise of modern, consumer capitalism at the end of the 19th century as process of mass commodification. While many aspects of life certainly came to be subsumed by the logic of markets at that time, value was not always provided by market mechanisms. On the contrary, one way in which economic elites sought to legitimize their wealth and status was by actively *removing* some things from the market. Thus, the late 19th century witnessed the
creation of a great many philanthropic institutions such as art and natural history museums, universities, lending libraries, and music halls. It is no accident, then, that precisely this period witnessed learned naturalists and their financial benefactors make vociferous arguments that “pure” science ought to be distinguished from “applied” research and isolated from marketplace demands. The patronage of science and other learned institutions served as a means for economic elites to demonstrate that a highly competitive economic system did not just generate vast wealth for a small segment of the population. Philanthropy can be seen as a material argument that, in addition to generating profits, capitalism was also capable of producing public goods, driving cultural in addition to economic growth. Not only that, but the decommodification of select goods and services was also a symbolic display of power. Helping to decide which artworks merited addition to a collection or which types of knowledge qualified as “pure” science served as a visible demonstration of one’s growing mastery over the marketplace for cultural goods.

Author: Sophie Ritson

Title: Dualities in Superstring Theory: From “oddity” to Epistemic Strategy

Abstract: Ed Witten is often presented as the primary initiator of the so-called ‘second superstring revolution’ at the Strings '95: Future perspectives in string theory conference. His vision of ‘string theoretic unity through duality,’ hinted at solution for two stumbling blocks for string theory: the existence of a multitude of consistent superstring theories and the lack of a non-perturbative definition of string theory. Conceptions of dual relationships between the various superstring theories were known prior to Witten's work but what emerges after is that they form the basis for a framework. In this talk I trace the complex and untold history at the borders of this revolution, and examine the changing role of dualities into an epistemic strategy. I argue that while myths abound about this revolutionary period, what was present after Witten's presentation was a newly populated string ontology based around an epistemic strategy provided by the dualities. Histories of string theory have almost entirely been told by members of the string theory community with almost a complete absence in the history of science literature. Curiously there is little to no record of Witten’s revolutionary presentation; the conference proceedings reference alternative work. Published papers, correspondence and oral interviews from before and at the perimeter of the conference provide some evidence towards constructing the boundaries so as to gain some understanding of the transformation.

Author: Meghan Roberts

Title: Loving and Learned: Jérôme Lalande, Amélie LeFrançois, and the Public Reputations of Women Astronomers

Abstract: Jérôme Lalande (1730-1807) was one of the most famous astronomers of the French Enlightenment. Like many of his peers, he often collaborated with friends and family, including a number of women. Unlike many of his peers, however, he went to great lengths to publicly credit and celebrate the work done by his female collaborators in his correspondence and publications. Convinced that women could make real contributions to astronomy and irritated by the prejudices of his contemporaries, Lalande encouraged women to study the skies. One of his long-term collaborators was his daughter, Amélie LeFrançois. He sung her praises in his correspondence and in publications such as his Astronomie des Dames and Bibliographie Astronomique. In these texts, he developed an emotional framework for understanding LeFrançois and her work: he stressed her sensitivity and deep connections to her family, and he made clear that her emotions fueled rather than conflicted with her scientific research. In so doing, he implicitly argued against assumptions that women’s alleged emotionality made them ill-suited for serious scientific research. In publicly crediting LeFrançois for her astronomical work while simultaneously praising her as an exemplary wife and mother, Lalande thus protected the public reputation of his daughter (shielding her from criticism that she was overly ambitious, undersexed, or immoral) and intervened in an ongoing debate about women’s intellectual and emotional capacities.

Author: Aileen Robinson

Title: Conjuring Trust: Optical Performance and the Formation of Scientific Spectacle

Abstract: In 1782, Gustavus Katterfelto—scientific popularizer and conjuror—magnified a drop of London water with a solar microscope, revealing, demonizing, and damning microbes. Katterfelto’s presentation purported to reveal the cause of the flu epidemic as well as awe audiences through its spectacular science and optical wonders. The production conjured hidden worlds through the microscope and traded on theatrical techniques of disbelief, deception, and revelation. Gustavus Katterfelto’s 1782 microscopic exhibition, coined “Wonders! Wonders! Wonders!” not only confused the boundaries between deception and revelation, authority and trust, but also manifested a symbiotic relationship between the histories of
Magic, theatre, and science. This paper investigates Katterfelto’s presentation as an optimal example of the twinning of magic performance, theatrical technique, and scientific instrumentation in the eighteenth century. Scholars have investigated the impact of this performance history on science communication; my work expands this work through the examination of specific theatrical and magical techniques that were included in public demonstrations of science and technology. Drawing from the history of magic, scenography, and scientific lectures, I query how Katterfelto deployed optical technologies using both magical and scientific methodologies. How did spectacular performances of science draw upon current genres of performance? I suggest that performances such as Katterfelto’s utilization of magical and theatrical techniques became endemic to popular scientific lecturing, assisting audiences in navigating among tensions between scientific authority, epistemic trust, and persuasive spectacle.

Author: Amy Rodgers

Title: How Are Historians Using the Isis Bibliography Today? Current Trends and Historical Research Practices

Abstract: In the spring of 2013, the authors surveyed a total of 675 historians of science and related scholars about their use of the Isis Current Bibliography. The survey was an internet questionnaire made accessible through Survey Monkey and publicized widely through electronic media. A majority of respondents were members of the History of Science Society but the demographics were very mixed. The results of the survey tell us much about how historians are currently using both print and digital resources and give us insights into their research habits and the way they use different media to find go about their work. The paper will discuss the results of the survey.

Author: Michael Rossi

Title: Drawing out Syntax: Phrase Structure Diagrams and the Neural Ontology of Language

Abstract: Phrase structure, or "tree" diagrams, are familiar tools used in modern theoretical linguistics for making the underlying syntactic structure of sentences visible, comparable, and, ultimately, real. This paper examines the ways in which a small group of researchers, mostly based at MIT and Harvard in the 1950s, '60s, and '70s, used phrase structure trees to argue not simply for the ontological reality of sentence structure, but for the ontological reality of a neurological seat of language -- a "language organ" -- universal to all human brains. This concept -- and the diagrammatic conventions upon which it rested -- became a powerful, if contentious, tool not only in linguistics, but in field such as neurophysiology, psychology, and speech pathology. As with other "paper tools" used in conceptualizing otherwise invisible scientific entities, phrase structure diagrams made theoretical entities manipulable: able to be broken apart and pieced back together; able to be experimented upon. But unlike, for instance, conventional depictions of subatomic particles and molecular composition, phrase structure diagrams translated between the ideal and the material; thought and neurons; words and things. As such, the proper use of phrase structure trees required both pen-and-paper manipulations as well as reexaminations of ontological questions such as "what is structure?" and epistemological questions about the nature of scientific evidence in order to draw the language organ out of the recesses of the brain.

Author: Rachel Rothschild

Title: Making the Invisible Visible: Scientific Expertise and International Policies on Acid Rain

Abstract: Acid rain first began to receive widespread international attention in the late 1960s, when data from the European Air Chemistry Network suggested that fossil fuel emissions were acidifying precipitation in Norway and Sweden. The findings prompted Scandinavian scientists to organize several international research projects on the atmospheric transport of pollutants across national boundaries and the environmental impact of acid rain. This paper analyzes the development of these cooperative atmospheric and ecological studies in intergovernmental organizations during the 1970s, and their mandate to provide "sufficient knowledge" to facilitate an international agreement on transboundary air pollution. An emerging class of intergovernmental civil servants, tasked with a clear mandate to produce policy solutions to environmental problems, was anxious to use scientific expertise to facilitate international regulations on acid rain. Yet the costs involved in fitting power plants with new pollution control technologies or moving towards cleaner energy led some countries and energy companies to exert strong pressure against any international accord on acid rain by arguing that the science was still uncertain. The participation of meteorologists and ecologists in such negotiations raises questions about the manner in which scientific consensus was reached, how results were translated to government representatives, and in what ways attacks on scientific credibility became a tool to avoid potentially costly reductions in pollution emissions. By examining the development of these scientific research programs alongside a regulatory regime for air pollution, I intend to shed light on a particularly revealing episode of environmental expertise and intergovernmental politics during this period.
Author: Pablo Ruiz de Olano

Title: Point-particles and Inexhaustible Atoms: Marxism and Particle Physics in Post-War Japan

Abstract: From the 1930s through the 1960s, Marxism exerted considerable influence over Japanese physics. As it is well-known, such influence is most obvious in the so-called Nagoya school of particle physics, which was founded by Soichi Sakata upon his arrival to the University of Nagoya in 1941. In this paper, I examine the accusations made by the Israeli physicist Yuval Ne'eman and the 1969 Nobel Prize winner Murray Gell-Mann that Sakata's dogmatic commitment to Marxism prevented Nagoya theorists from developing a successful theory of the strong interaction, and argue that such accusations are not justified. Although Kent Staley, Laurie Brown and others have attempted to defend the Nagoya school from Ne'eman's and Gell-Mann's claims, my account differs from theirs in that it does so by situating it within a wider research program in non-local field theory that was launched by Hideki Yukawa in 1950. As I point out, it is true that Yukawa's refusal to identify elementary particles with mathematical points reminded of Lenin's and Engels' assertions that there could be no "inexhaustible" particles, and it is also true that this motivated, at least in part, Sakata's adherence to Yukawa's program. However, the exchange between the two camps is better understood as a debate between two research programs in particle physics, that disagreed about the role of locality in quantum field theory, than it is understood by dismissing Sakata's approach as unscientific.

Author: Gina Rumore

Title: Expanding Time and Space: Historical Perspectives and the Long-Term Ecological Research Network

Abstract: In 1980 the National Science Foundation put out its first call for proposals (CFP) for Long-Term Ecological Research sites, followed by a second CFP in 1981. These two competitions resulted in the funding of 11 sites, spanning the contiguous United States. Today there are 26 sites ranging from Tahiti to Antarctica, including nine of the original 11. While the goal of these research sites has, from the beginning, been to foster interdisciplinary study of the various ecosystems, the disciplines involved have been those traditionally associated with ecosystems studies, and the systems under study, for the most part, have not been human-dominated systems. Since the mid-1990s, however, conditions have slowly changed, both at NSF and within the Network, making the research environment much friendlier for collaborative work with social scientists, fostering what today is being called the "transdisciplinary" approach to ecological research. The agents of this evolving collaboration have been the LTER researchers themselves, including those working within NSF. This paper will explore the author's experience working as a historian among ecologists within the LTER, analyzing the changes in the Network that have made such collaborations desirable, discussing ongoing collaborations on current ecological research, and suggesting future possibilities for mutually beneficial collaborations.

Author: Brent Ruswick

Title: Your Profession has a Past, You Know

Abstract: I will talk about my experiences/course design with the course at the Nebraska Methodist College of Nursing and Allied Health, a college run by one of the major hospitals in NE. The Dean of Arts and Science is committed to having nurses who are broadly educated and familiar with the humanities, and so I will be using History of Medicine and Science as a vehicle for introducing students on a professional degree path to the humanities and history.

Author: Funke Sangodeyi

Title: Transforming the “Normal Flora”: The Making of the Ecological Human Body

Abstract: This paper examines how the microbes that live in and on the human body (the “normal flora”) were first conceptualized as "indigenous" floras by bacteriologists working on disparate body sites (skin, mouth, gut, vagina) in the mid 20th century, and how those distinct floras came to be conceptualized as an integral part of the human body by human microbiome researchers in the 21st century. This paper argues that this radical reconceptualization of the body as an “ecosystem” was first driven by biomedical researchers in clinical subspecialties (dermatology and dentistry, for example) looking to establish scientific bona fides for their fields and manage the practical problems of clinical practice. Their work served as a focal point for further investigation, governmental regulation and everyday practice as rising anxieties about the overuse and effects of chemicals, antibiotics and antimicrobials recast the idea of health in ecological terms. The application
of metagenomic techniques to the body in the 2000s, largely driven by the NIH Microbiome Project, served to concretize and legitimize this reframing of body and flora among scientific elites. Key to the transformation of the body-flora relationship was a shift in the meaning of "normal" with respect to the body in health and disease in an ecological age.

**Author:** Matthew Sargent

**Title:** Personal Science vs Corporate Enterprise: Gathering Indigenous Botanical Knowledge in Seventeenth Century India

**Abstract:** The founding of the world’s first multinational corporation – the Dutch East India Company (VOC) – in 1602 created an organization of unprecedented scale, a “nation unto itself,” with a trading network that stretched from the Netherlands to Japan. Yet its history is not merely that of a successful spice trading enterprise; the Company also acted as a matrix for new forms of cross-cultural interaction as well as a conduit for novel information flows. During the 1670s, for example, Hendrik Adriaan van Rheede tot Drakenstein (1636-1691), the commander of the VOC enclave in Kerala, convened a council of local experts to gather information for his survey on the botany of India. Debating in Dutch, Portuguese, and Malayam this collection of high-caste Brahmans and low-caste “tree climbers”, Indian doctors, Dutch scientists, Catholic priests, and local translators argued over the identity and useful properties of local plants. Motivated by his inability to gather information on the local natural resources from a single source, van Rheede’s information gathering enterprise cut across ethnic, religious, and class differences that had been in place for centuries. By comparing van Rheede’s project with that of his collaborator, a lone Italian Carmelite monk named Fr. Matthew St. Joseph, this paper will also explore the ways in which the demands of a global corporation shaped the way that local knowledge was depersonalized and rendered mobile.

**Author:** Jayita Sarkar

**Title:** ‘A Bullock Cart on Nuclear-Powered Wheels’: Nuclear Science, Indigeneity and the National Development Narrative in India

**Abstract:** Throughout the twentieth century, national science and technology policies have embodied the primary endeavour of the ‘post-colonial catch-up’ of newly-independent countries. Nuclear science and technology representing the highest form of scientific prowess of the past century, tended to be incorporated into the state-sponsored development project, as was the case in India. The Indian atomic energy programme was represented by its elites as significant steps towards emancipating the country from its backwardness through a science-led progress. While no national nuclear programme is indigenous, the discourse of indigeneity ran deep in the India. On one hand, the task of national development in the resource-scarce country necessitated scientific projects which make an immediate contribution to improving the lives of the citizens. On the other hand, the discourse of indigeneity underlined the need to establish an indigenous scientific knowledge-base and hence justified curiosity-driven research or ‘science for science’s sake’. The trajectory of the Indian atomic energy programme thus raises three significant questions, which this paper aims to answer: First, how does the aspect of national sovereignty (which is intrinsically related to the question of indigeneity) play out over technology transfers from foreign countries in the field of atomic energy? Second, how does the discourse of indigeneity configure in the encouragement of curiosity-driven scientific research in atomic energy and why? Third, how is the economic impact of such curiosity-driven scientific projects in a resource-scarce country like India underplayed?

**Author:** Melania Savino

**Title:** The Development of Archaeological Practice in the Turkish Republic

**Abstract:** The practice of archaeology began during the Ottoman Empire as a European tool to explore the mythical ancestors of western civilisation. The first archaeologists arrived in the Ottoman territories moved by the desire to locate Classical and Biblical antiquities, the focus of European interest since the eighteenth century. Archaeology in this first phase was an instrument of control and power adopted by western governments to systematically study the colonised landscape, surveying it and mapping it. During the late nineteenth century, a new consciousness about the past developed among the Ottoman elites as part of the process of modernization that was inspired by European models. This period was important for establishing the dialectic by which the subsequent Republican government would practice and legislate archaeology. After the foundation of the Turkish Republic the discipline of archaeology underwent a profound transformation, becoming one of the main fields of investment for the government that was aiming to create a national Turkish identity and to legitimise the new Republic. Influenced by the new archaeological theories developed in the first half of the twentieth century, numerous excavations were conducted in Anatolia starting in the 1930s, and different periods and civilisations were emphasised to legitimise the newborn nation. Illustrating the excavations carried out in the country and problematizing the research policies
behind them, this paper aims to explore the combination of national and international factors that contributed to a radical revolution in the practice of archaeology in the Turkish Republic.

**Author:** Karen Sayer

**Title:** The Aesthetics of the Invisible: The Design and Meaning of Nineteenth-Century Aids to the Deaf

**Abstract:** Although among the UK’s most widely used personal technologies, the hearing aid is all but invisible in the histories of medicine, technology, and disability. Yet collections of hearing aids, advertising, medical literature and catalogues demonstrate that there is a rich and complex history to be told of the diverse experiences and understanding of hearing aids as a means to handle hearing loss. The proposed paper will address whether analysis of the material culture enables us to better understand the histories of the deaf and hard of hearing in the nineteenth century, i.e. the ways in which hearing aids shaped the meanings of deafness in Victorian Britain, by focusing on examples held by the Thackray Medical Museum, Leeds, UK, (the largest collection in the world of aids manufactured by FC Rein, the oldest hearing aid manufacturer estab. c. 1800). Many users sought, it seems, discretion and many aids were disguised -- examples from Rein include hair combs, bonnets, and lace headbands – most aids were black. But not all aids were concealed – some London Domes were made of polished brass, sterling silver and ornately engraved – so some users were unembarrassed about using highly conspicuous devices. In considering these aids through the lens of their design (aesthetic and technical), drawing on the disciplines of disabilities studies, social, medical and cultural history, the experiences of the deaf/hard of hearing, framed by class and gender, may be key to interpretation.

**Author:** Sara Schechner

**Title:** Between the Museum and the Academy

**Abstract:** Sara Schechner earned degrees in physics and the history and philosophy of science from Harvard and Cambridge and has built a career between the museum world and academia, with her work centered on the former. She mentors students who want to pursue careers in the museum world, and is on faculty of Harvard's museum studies program. Before returning to Harvard's history of science department, Schechner was chief curator at the Adler Planetarium and Astronomy Museum in Chicago.

**Author:** Robin Scheffler

**Title:** Remembering the “Failure” of Cancer Virology and the Fashioning of Molecular Biology’s Second Wave

**Abstract:** Acts of memory-making have played an important role in establishing molecular biology as an autonomous discipline. In this paper, I explore the history and reception of the 1974 “Zinder Report,” a critical evaluation of the National Cancer Institute’s NASA-style Virus Cancer Program (VCP); a program intended to develop a cancer vaccine. In the recollection of a circle of molecular biologists, the release of the Report resulted in the collapse of the VCP, whose “failure” represented the triumph of scientific prudence over the misplaced public expectation that a therapeutic “moonshot” agenda could be imposed on the biological sciences community. Yet the VCP continued, and indeed expanded, for years after the Zinder Committee’s report. Moreover, the National Cancer Institute’s cancer virology initiatives underwrote much of molecular biology’s “second wave”: its transition to the study of complex eukaryotic organisms. How might one account for this divergence between history and memory? Using new archival sources, I place the authorship and reception of the report within the insecurity felt by the molecular biology community regarding the governance of scientific research. That the fact that the report was never formally issued allowed a few vocal molecular biologists to shape the memory of the Report’s critique, which supported further efforts to divert funds from cancer research to the support of molecular biology. This is neither to condemn these molecular biologists nor to redeem the VCP, but to show how these memories of “failure” played a role in shaping the “correct” relationship between laboratory research and therapeutics.

**Author:** Arne Schirrmacher

**Title:** From Particles to Pedagogy. Alternative Careers of US Atomic Physicists in the 1960s: Frank Oppenheimer, Harvey E. White and Robert Karplus

**Abstract:** Why is it that we find Frank Oppenheimer, who was developing a proton accelerator with Luis Alvarez in the
years after World War II, observing school children crash his self-build science exhibits some 20 years later? How come that
Harvey White, who had worked on atomic spectroscopy and who had pictured the electron clouds of atoms, was addressing
audiences on TV nationwide at 6 in the morning in the 1950s? And why do we find Robert Karplus, whose incredible
calculations convinced physicists in 1949 of the validity and applicability of QED, wondering with elementary school
children how to relate objects in space two decades later? – My paper will show a decisive impact of Sputnik shock
accelerated spending on educational reform on the reinvention of the science museum. In particular in the Bay Area one can
find both the derailed grand plans for the Lawrence Hall of Science at Berkeley and the improbably successful alternative
project of the San Francisco Exploratorium. In a twisted story, including the three mentioned physicists, I will show that the
very person, who aimed at an educational project had to resort to reinvent the science museum, while those with plans for a
momentous museum in honor of Lawrence did never succeed.

Author: Sigrid Schmalzer
Title: Yuan Longping, Hybrid Rice, and the Historical Significance of Science in the Cultural Revolution and Beyond

Abstract: Acclaimed as the "father of hybrid rice," Yuan Longping (1930-) is far more famous in China than, for example, the
American "father of the green revolution," Norman Borlaug, is in the United States. Yet Yuan's path to fame and the
significance of the Cultural Revolution-era research for which he is credited are deeply convoluted even by the high
standards of convolution found in most inventor-hero narratives. Yuan Longping's name is scarcely found in Cultural
Revolution-era records; the invention of hybrid rice appears rather as a major state-sponsored project involving many
participants across numerous provinces. It was in late 1976 that Mao's first successor, Hua Guofeng, brought Yuan Longping
into the spotlight as evidence of Hua's successful mobilization of the Maoist mass line for the development of science and
technology in Hunan Province. Yuan's fame survived Hua's 1978 fall from power, but the significance of Cultural
Revolution-style "mass science" quickly faded from the history books, and Yuan began to be celebrated for inventing hybrid
rice despite and not because of the politics of the Cultural Revolution. Still, Yuan's public persona as an "intellectual peasant"
retains something of the romance of mass science and speaks to the lingering ambiguities the legacy of Cultural Revolution
science holds today.

Author: Karen-Beth Scholthof
Title: From the Lab to the Field: Tobacco Mosaic Virus, Mendelian Genetics, and Crop Improvement

Abstract: Tobacco mosaic virus (TMV) has been both a scourge to agriculturists and a boon for molecular biologists. TMV
is a particularly intriguing reciprocal object—it has been used to investigate fundamental questions about the biology of
viruses and to develop scientific solutions for crop improvement. In 1929, Francis O. Holmes observed that certain tobacco
plants produced pin-point necrotic lesions in response to TMV. From this observation, Holmes developed the idea that this
host response was due to a single dominant gene. This insight and the work stemming from it would lead to the finding of
similar dominant genes in plants evolutionarily related to tobacco—pepper, tomato, and eggplant. These these genes could be
used to control TMV disease in crop plants. By 1936, as a plant virologist at the Rockefeller Institute for Medical Research
(Princeton, NJ), Holmes had identified and moved a dominant resistance gene (L) from Tabasco peppers to protect
commercial varieties of bell pepper, using the TMV-necrotic response as a unit of assay. By 1938, Holmes had success in
moving gene N, which was responsible for the local necrotic lesion response in tobacco, to commercial tobacco varieties. My
interest is in determining how Holmes developed the idea that a necrotic local lesion was the outcome of a host resistance
gene product acting on virus infection and, in turn, how this necrotic-type response enabled him to take the N-gene from
laboratory to the field.

Author: Margaret Schotte
Title: Triangulating Through Mathematical Seas: Teaching Trigonometry in Early Modern Navigational Manuals

Abstract: Early modern maritime educators roundly debated the place of mathematics in navigation, as well as the cognitive
capacities of aspiring navigators. Most navigational textbooks in 16th- through 18th-century Europe strove to present
arithmetic, geometry and trigonometry as simply as possible, while many manuals promised alternative techniques that
avoided math entirely. This paper focuses on a pair of popular and influential textbooks that contradicted this trend.
Guillaume Denys's L'Art de navigateur par les nombres (Dieppe, 1668) and Pieter Holm's Stuurmans Zeemeeter [Navigator's
Sea-Measurer] (Amsterdam, 1748) both prioritized numbers. This paper will assess how Denys and Holm explicaded
trigonometric problems, such as calculating latitude or determining a vessel’s course. I will then compare these to the same
topics in other introductory textbooks, where authors relied upon diagrams to foster comprehension, or promoted instrumental solutions that bypassed mathematical equations. By focusing on a single element of these manuals, we can begin to gain insight into how the diverse backgrounds of nautical textbook readers would have shaped their learning processes, and to better understand the range of effective pedagogical strategies. It also considers the paradox of Holm’s textbook, which one scholar deemed “useless to anyone but his students.” If a book could not be used without its author there to explain it, did it fail entirely in its didactic purpose—or was the ulterior motive to attract more students to Holm’s school? This paper argues for more attention to commercial factors when considering the form and function of pedagogical materials.

**Author:** Sarah Scripps

**Title:** The Role of Historical Narratives in American Youth Science Clubs, 1930-1950

**Abstract:** This paper evaluates the use of historical narratives at the American Institute of Science, the founding agency of the contemporary U.S. national movement of youth science clubs and fairs. Throughout the 1930s and 40s, popular educators at the Institute turned to the history of science to construct compelling tales of the ingenuity of scientists past. Serving as a mechanism to train a rising generation of scientists and engineers, these stories were intended to inspire students to harness their own potential for the good of the nation. With the rise of the Cold War, these historical constructs turned decidedly towards national defence, with an increased urgency in finding talented youths across the country. Promotional headlines such as “A future Faraday or Madame Curie may be a student in your class today!” emphasized the role of young experimenters in serving as America’s leaders during a time of national crisis. Student participants, however, often employed the past for their own devices. Through youth-written magazine columns about Louis Pasteur or Antonie van Leeuwenhoek, sharing history-related jokes or trivia questions, reenacting famous experiments, or submitting historical dioramas to science fairs, club members constructed a common vernacular about the past in order to establish a sense of community among a vast network of young experimenters. These myriad uses of the past illuminate how students and educators alike viewed contemporary science in terms of a broader historical trajectory, and how those narratives ultimately informed their vision of the nation’s future.

**Author:** Ioanna Semendeferi

**Title:** Experiencing Science Ethics: Living in the Present-Connecting with the Past

**Abstract:** The moral responsibility of scientists and the need for improvement in science-ethics education cannot be overestimated. Teaching regulatory compliance should not be the primary goal of ethics education. Scientists’ motives for unethical behavior remain largely the same, despite regulatory progress. How can history of science help in this respect? And, how can one connect the historical record to present realities, imparting a potent ethics message? To address this challenge, we have developed a staged approach that interlocks the past with the present. First, we lecture on landmark cases in science with debates where the students “experience” how to confront ethics rivals by articulating arguments either in favor or against the protagonist scientists. In parallel, they participate in a practicum, where they work as interns in science labs or against the protagonist scientists. In parallel, they participate in a practicum, where they work as interns in science labs or they perform peer review of manuscripts under supervision. The practicum brings real experiences and current perspectives on the ethical themes represented in the historical cases. Quantitative evaluation shows that our teaching approach is promising. The students not only recognize ethical issues but also they acquire moral sensitivity. The latter is important because just knowing what is ethical may not be enough. Vivid impressions and latent emotions can cultivate morality increasing the likelihood of future ethical behavior.

**Author:** David Sepkoski

**Title:** “Replaying Life’s Tape”: Simulations, Databases, and the Reconstruction of the Past

**Abstract:** In a famous thought experiment, Stephen Jay Gould asked whether, if one could somehow rewind the history of life back to its initial starting point, the same results would obtain when the “tape” was run forward again. This hypothetical experiment is generally understood as a metaphor supporting Gould’s philosophy of evolutionary contingency, which he developed and promoted from the late 1980s until his death in 2002. However, there was a very literal, non-metaphorical inspiration for Gould’s thought experiment: since the early 1970s, Gould, along with a group of other paleontologists, was actively engaged in attempts to model and reconstruct the history of life using computer simulations and database analysis. In some cases, computer programs were developed that generated hypothetical fossil morphologies, or that randomly simulated evolutionary phylogenies, which could then be compared with examples and patterns found in actual fossil data. In others, simulation models were used to generate hypotheses about the nature of diversification and extinction that could be tested in the empirical fossil record. These projects not only demonstrate the impact that computers had on data analysis in
paleontology, but also shed light on the close relationship between models and empirical data in data-oriented science. I will argue that the models developed by paleontologists through simulation and quantitative analysis of the empirical fossil record in the 1970s and beyond were literal attempts to “replay life’s tape” by reconstructing the history of life as data.

**Author:** Efram Sera-Shriar

**Title:** Close Encounters of the Human Kind: Ethnographic Observations of Indigenous Peoples from the Beagle Voyage Narratives, 1826-1836

**Abstract:** During the first half of the nineteenth century, most researchers interested in human variation never left the shores of Europe. To substantiate the trustworthiness of their racial descriptions, these researchers were reliant on the observations of travellers, missionaries and military officers alike to furnish them with eyewitness accounts of extra-European peoples in their natural environments. Travelogues became a staple resource for acquiring data on different races. This paper examines the intersection of visual culture, voyages of exploration and British ethnology in the first half of the nineteenth century. Building upon the works of James Moore, Adrian Desmond, Janet Browne and others, it will show how books such as Robert Fitzroy’s Narrative of the Surveying Voyages of His Majesty's Ships Adventure and Beagle (1839) were important evidentiary resources for early British ethnologists. The written reports and illustrations from these books were some of the earliest and most detailed representations of certain racial groups. Although much work has been done on the significance of Charles Darwin and Fitzroy’s descriptions of the Patagonians and Fuegians from their voyage, relatively little has focused on the account of Phillip Parker King who was the commanding officer from the first voyage between 1826-1830. Thus, this paper will focus on King’s narrative. In addition, it will look at how early ethnologists utilised these travel reports and images in their developmental theories and classifications of humans.

**Author:** Adam Shapiro

**Title:** The Politics of History of Science in the Science Classroom

**Abstract:** The political debates over school curricula in recent decades have influenced both the teaching of science and the teaching of history. At the same time, combatants in many popular (and legal) controversies over particular branches of science—including evolutionary biology, vaccination, tobacco science, and environmental science—have appealed to history as a way to legitimate their claims about the scientific status of their positions. Considering these two trends taken together, this paper will ask how controversies over science and over school content have impacted the presentation of the history of science in the science classroom. To what extent have textbook publishers, state regulators, curriculum creators, and other parties been affected by an environment of increased scrutiny and contestation? Typically, the role of history of science in science education has been seen as an introduction to the nature and norms of science or of a particular discipline—or as a counterproductive version of such an introduction. But in this setting, the history of science as presented in science classroom can no longer be seen as primarily a point of entry to the science as such, but must be regarded as a locus of social contestation in its own right.

**Author:** Grace Shen

**Title:** Knowing and Showing: Li Siguang and the Politics of Geological Demonstration

**Abstract:** During the 1920s and 1930s, Li Siguang (J.S. Lee, 1889-1971) was known as China’s foremost theoretician in the geosciences, with a track record of taking on international giants on everything from continental drift to Pleistocene glaciation. Ever the contrarian, Li resisted pressure from Chiang Kaishek to focus exclusively on applications in the War of Resistance, but as soon as the People’s Republic of China was founded, he led the campaign to reorganize China’s geological institutions along practical lines. On the surface Li’s high-profile efforts at mass mobilization seem to support the familiar view of Maoist science. However, Li also enjoyed an unusual scientific celebrity that highlighted his personal expertise even at the height of the Cultural Revolution. To untangle these intersections of mass vs great man science and applied vs theoretical geology, this paper will juxtapose three cases of Cultural Revolution geology that were shaped by Li Siguang: geological education, the search for new petroleum beds in the Ordos valley, and the development of the Institute of Geomechanics as an international showcase.

**Author:** Megan Shields Formato

**Title:** Quantum Theory at the Summer Cottage
**Abstract:** Much has been written about Bohr's Institute for Theoretical Physics and its role in the development of Quantum Theory and Quantum Mechanics from 1918-1927. But what of Niels and Margrethe Bohr’s summer cottage in Tisvilde? The oral histories, correspondence and memoirs of key figures in the development of Quantum Theory frequently reference holidays with the Bohrs, particularly weekend and summer trips to Tisvilde, as important sites of research and conversation. This paper seeks to describe how being outside of the culture, schedule and obligations of the Institute and among family and children, fostered different kinds of scientific work. In particular, the role of Niels Bohr’s wife, Margrethe, is easier to see and make sense of in this setting.

**Author:** Indianara Silva

**Title:** Understanding the Scientific Practice: realism, pragmatism, and photons

**Abstract:** Developments in the second half of the 20th century, such as the Hanbury Brown-Twiss effect, the creation of quantum optics, and the photon-antibunching effect, influenced the way by which physicists came to understand the concept of the photon. During their discussions about what a photon is, two philosophical interpretations underlying physicists’ point of view came to the fore: realism and pragmatism. For instance, in the HBT experiment in which a low-intensity beam of light was split into two components by a half-silvered mirror and coincidences were detected some physicists tried to create images of photons in order to explain it. This made things very difficult at the time because “there is no satisfactory mental picture of light which gives the right answer”, according to R. Hanbury Brown. In answer to the question of which concept of the photon emerged from quantum optics, Roy J. Glauber, who constructed the coherent states for the electromagnetic field, also highlighted that it was far from straightforward to create conceptual images about what photons are, but he did know how to do mathematics. If the mathematics works properly, thus there is no need for creating pictures of a photon. Thus, it seems that physicists became pragmatists concerning the photon since embracing images of it would not help at all to solve experimental and theoretical problems. Our analyses will draw some conclusions about the scientific practice of physicists related to discussions on the concept of the photon at the time.

**Author:** Josep Simon

**Title:** Transnational Pedagogy? The Itineraries of the Physical Science Study Committee in Mexico

**Abstract:** The Physical Science Study Committee (PSSC) is an outstanding product of US Cold War physics that drove efficiently the political ambitions of US physicists from the top of Academia and Government to the bottom of the nation’s school classrooms. It is also an excellent example of the making of US hegemony through international politics and corporate philanthropy. The PSSC illuminates the processes of nation building through discourses of international competition and the export of national imaginaries. Latin American teachers attended its training courses early on, and PSSC members were major agents in international organizations such as UNESCO and the International Commission on Physics Education, and in national projects in other countries. The PSSC products were used in Mexico from the 1960s. Actually, Mexico presented a relevant national and international role in public education: at the core of nation building through comprehensive schooling and elite research, its Comisión Nacional de Libros de Texto Gratuitos developed an ambitious project of pedagogical innovation providing free primary school textbooks; and Mexico’s place in international education forums was also significant (e.g. UNESCO, CREFAL). However, in Mexican universities American physics textbooks were used generously, after translation in Mexico and in Spain, both in the orbit of US geopolitics. This paper studies the circulation and appropriation of PSSC pedagogy in Mexico, paying attention to the role of science education in the making of Cold War nationalist and internationalist discourses, and the amphibian nature of historical actors involved in the development of allegedly transnational organizations.

**Author:** James D. Skee

**Title:** That’s where they Bought the Land, That’s where they Built the Park: Operations Research, the Disney organization, and Business Decision Making in Cold War America

**Abstract:** Science’s place in American business after World War II may be thought of as either a product of industry (e.g., biotechnology), or as a means to organize the management and operation of business itself through new scientistic methods such as operations research (“OR”) and systems analysis. This paper contributes to the latter by exploring how executives in the Disney organization worked with consultants to apply the new methods of OR to the process of making business decisions. Examples discussed include: the Disneyland location studies conducted by Stanford Research Institute consultants in 1953-54; work completed by Economics Research Associates (“ERA”) for Disney’s participation in the 1964-65 New York World’s Fair (1963-64); and finally several feasibility and location studies for “Project Future”/EPCOT (today’s Disney
World) – again completed by ERA analysts – from the late 1950s through mid-1960s. While particular to the nascent industry of mass leisure, these examples suggest trends throughout American industry from the 1950s through 1960s. In addition, this paper speaks to the meaning of rationality to those individuals charged with managing business enterprises in the United States during the Cold War, and to how OR practitioners adapted their work in support of their clients’ needs.

**Author:** John Slattery

**Title:** The Fall of the American-Priest-Scientist: John Zahm’s Attempt to Bridge Evolution and Catholicism

**Abstract:** Born only eight years before Darwin’s Origin, Rev. John Zahm, CSC served as both a Professor of Chemistry and Physics (1872-1896) as well as Vice-President (1874-1881) at the University of Notre Dame, leading the charge for the small Catholic university to become a well-respected scientific research institution. While he briefly attained widespread respect and admiration—especially within the United States—his unwavering commitment to the peaceful coexistence of the theory of evolution and Roman Catholicism ultimately led to a Vatican censure and his complete departure from the field of “theology and science.” Building upon recent research by Scott Appleby and David Burrell, this essay will argue that Zahm’s theological mistakes were not primarily an acceptance of “modernism,” but an implicit repudiation of central theological methodologies in the discussion between faith, reason, and science. As such, this essay will first outline the discussions surrounding “faith and reason” in the Vatican in the later 19th century, including an introduction of the term “science” into the language of the 1st Vatican Council. This syntactical introduction set the stage for a very specific interpretation of scientific advancements which must be directly understood in light of the scholastic resurgence in natural philosophy. In this light, Zahm’s work will be shown as failing to dialogue directly with this renewed methodology—specifically, with the assumed two-fold but hierarchical nature of faith and reason, whereby conceptions of reason or science can in no way affect revelations received through faith.

**Author:** Angela Smith

**Title:** “Evolution, Alchemy, and the Odyle Force: Romantic Science in Scotland”

**Abstract:** Scotland, particularly Edinburgh, was an axis of alternative scientific activity and theory from James Hutton's proto-Gaia conception of Earth as super-organism in the 1780s to William Gregory's Odyllic interpretation of Mesmerism in the 1850s. Scotland's interrelationship with the Continent, through both intellectual and social exchanges, along with its innovative speculative tradition dating back to the early Enlightenment, combined to produce an array of scientific theories of a particularly Romantic nature during the late eighteenth and early nineteenth centuries. This paper will explore the Scottish Romantic tradition in science through both its most notorious as well as some of its lesser known theories and theorists. From the phrenology of George Combe to the alchemical ideas of Samuel Brown to the mysticism of naturalist Edward Forbes, I will trace how German, French, and British ideas in literature, art, and philosophy fertilized and nurtured this movement. The social networks which these men built, including Forbes' Brotherhood and Combe’s circle, were crucial to their forging this new tradition, which contributed to the coming wave of British Idealism in philosophy and, even more importantly, helped to sustain a teleological view of nature well past the decade of Darwin’s Origin. Weaving together many of these converging threads was Robert Chambers and his Vestiges of the Natural History of Creation, a scientific Romance dressed in a particularly Scottish fashion, and emblematic of a tradition with features as unique as the Scottish Enlightenment -- Scottish Romantic Science.

**Author:** Pamela Smith

**Title:** Crafting Things, Crafting Words

**Abstract:** Words cannot fully express the crafting of things. Scholars are crafters of words, so how do historians of science and technology convey the crafting of things in their work? This paper will consider alternative modes of presenting, persuading, and teaching about crafting things and words.

**Author:** Sierra Smith

**Title:** Politics, Scientific Priorities, and Big Science: The Development of U.S. Radio Astronomy

**Abstract:** This paper will analyze the growth of radio astronomy in the United States as a case study that complicates the traditional narrative of the rise of Big Science. Historical analysis of Big Science’s development has often focused on the
visible, openly-contentious experience of nuclear physics in the latter half of the twentieth century. Scholars have examined the extent to which the deep connections between the rise of Big Science and the growth of the Military-Industrial-Academic Complex shaped the scientific research agenda at large, federally-funded scientific institutes. The conclusions of many of these studies have often been bleak; however, more recently, scholars have begun to examine the validity of these conclusions for other scientific disciplines. As the first large-scale scientific research facility funded by the National Science Foundation, the National Radio Astronomy Observatory (NRAO) exemplifies many of the aspects of Big Science. This paper will examine the struggle to establish a national facility for radio astronomy and NRAO’s development into a world-class astronomical observatory. Particular attention will be paid to the formation of NRAO’s Open Skies policy, which awarded observing time to the “best science” regardless of institutional affiliation and nationality, and the movement of the radio astronomy away from physics and engineering and towards traditional astronomy. This paper will use radio astronomy as a case study to examine the complex interactions between federal funding, political priorities, and scientific research agendas during the Cold War.

Author: Fiona Smyth

Title: Transatlantic Communications: Sound, Space, and Science

Abstract: The application of acoustics to architecture in early twentieth-century Britain and Ireland drew heavily upon contemporary American developments which migrated across the Atlantic through a set of professional linkages and detailed personal correspondences. Especially significant personal linkages incorporated Harvard physicist Wallace Clement Sabine (1868-1919) and British-based architect, theorist and acoustician Hope Bagenal (1888-1979). Through the pioneering work of Hope Bagenal, acoustics first found acceptance within the architectural fraternity in Britain. His influence was propagated initially through consultancy and teaching - both of which centred around the Architectural Association School in London - later finding fruition in the instigation of the acoustics research division in Britain’s Building Research Station and in the foundation of the dedicated Acoustics Group of the Physical Society. His acoustic expertise was sought for buildings as diverse in function and scale as the Royal Albert Hall in London and the Town Hall in Newry, and his publications became indispensable texts in the curricula of architectural departments in universities throughout Ireland and the British Isles. Of primary importance in instigating the conversance between scientific theory and practical design application in architecture which underpinned Bagenal’s work is a series of letters exchanged in 1914 between Bagenal in London and physicist Sabine in Harvard. With reference to that nexus of correspondence and the subsequent working papers, publications and letters of Hope Bagenal, the present paper traces a chain of influence which had a fundamental impact on the practical application of acoustic science within architecture in Britain and Ireland.

Author: Mariana Sombrio

Title: “Women in the Institutionalization of Science in Brazil: Bertha Lutz and the naturalist tradition (1939-1951)”

Abstract: Recent research on gender and science in Brazil examines the strategies and relationships that enabled some women to establish their own scientific careers. This paper uses the life and work of Bertha Lutz (1894-1976) to discuss these issues. Lutz was a Brazilian scientist who worked for forty-five years in the National Museum of Rio de Janeiro. Daughter of the Brazilian scientist, Adolpho Lutz, she completed her higher studies in France which included Botany, Biological Chemistry and General Embryology. She was hired by the National Museum as a secretary in 1919 and later was promoted to the position of “naturalist”. At the same time, Lutz founded a feminist association for the intellectual emancipation of women and dedicated herself to the practice of science and to the feminist movement. She was also a member of the “Brazilian Inspection Council on Artistic and Scientific Expeditions” (1939-1951) where she was responsible for inspecting and licensing foreign scientific expeditions. Through her work on the Council and in the museum, Lutz developed an international network of naturalists who informed her work and impacted her career. This paper situates the history of women in science in Brazil within a more global discussion, analyzes the role that networks, family, and partnerships played in consolidating the scientific careers of women like Lutz, as well as recognizes the participation of women in the institutionalization of science in Brazil during the mid-twentieth century.

Author: Baojie Song

Title: Love China, But Not the Bomb: A Cultural History of Hoff Lu

Abstract: This article uses cultural analysis to investigate the life of a less well-known Chinese nuclear physicist, Hoff Lu. He was trained in nuclear physics in the U.S in the 1930s and was selected as one of the experts to work for the Chinese
nuclear bomb program after he returned to China. However, he chose to quit his job when the construction of the bomb was about to begin. He said that the atomic bomb is an example of being “hard to build while easy to destroy”. Another example of this is the Chinese cultural tradition. While the bomb was being built in China despite the worldwide concern that nuclear weapons would lead to the total destruction of mankind, Lu’s favorite old Peking Opera and traditional Chinese culture was under violent destruction driven by the communist ideology of “destroying the old world and build a new one”. By looking at the symbolic meaning of Peking Opera, this article will offer some insights into how an individual made sense of the conflicts between western science, Chinese tradition and the communist ideology in the history of modern China.

**Author:** Ellan Spero

**Title:** Bridging for Innovation: MIT’s “Technological Education” and Academic-Industrial Research between World Wars

**Abstract:** In 1920 MIT’s president R.C. Maclaurin announced that this science and engineering institute would become “the greatest consulting body in the world.” This bold statement was part of the “Tech Plan,” a vision to link MIT’s research to industrial practice that called for both collaboration with and financial contribution from industrial partners at an unprecedented scale. In the years that followed, research and curricular programs aimed at “industrial service” took various forms, from small projects embedded in personal networks to formalized centers exemplified by the Research Laboratory for Applied Chemistry (RLAC), as well as smaller scale interdisciplinary labs such as the Textile Research Laboratory, which convened personnel from several departments to work on challenges associated with a particular industry. At the pedagogical core of these laboratories and their associated curricula was a concept termed by MIT’s President (1930 - 48) K.T. Compton, a “technological education.” By this, Compton meant to combine both theoretical and practical goals and expertise into a new kind of education designed to foster creativity and leadership in the sciences and engineering, one which could be clearly differentiated from vocational training. Using MIT-based case-studies of both laboratories and bureaucratic structures, I examine the role of academic-industrial partnerships on discipline formation (both through classroom and laboratory work) in the context of ‘industrial service,’ academic leadership, and the establishment of both informal and codified institutional networks and organizational structures, as a process of boundary negotiation, and as one of broader strategic institutional change in the context of economic uncertainty.

**Author:** Alistair Sponsel

**Title:** Naval and Zoological Opportunism during World War II: The Case of the Snapping Shrimp

**Abstract:** This paper argues that the idea of opportunism is more analytically useful than that of exploitation in understanding the relations between US scientists and their military patrons during and after WWII. I trace the history of a distinct natural phenomenon through several opportunistic redefinitions in the brief period from about 1942 to 1945. This phenomenon was a crackling noise in the ocean that had, it turns out, been widely noticed but little contemplated until 1942. With the development of sonar listening devices for the detection of submarines, this noise became a practical obstacle to naval defense of the US coastline. Through field observation and laboratory experiments the zoologist M.W. Johnson (then working for the University of California Division of War Research) concluded that the noise was produced by large populations of a two-inch marine invertebrate, the snapping shrimp. Johnson opportunistically redefined the noise as a diagnostic tool for producing ecological knowledge: he began to use the presence of the crackling noise as a way to locate large populations of snapping shrimp, and in turn to determine that such populations (and their characteristic noise) could reliably be predicted to occur under a specific, rather common, set of environmental conditions. Such knowledge was of tactical importance to the Navy, which also opportunistically redefined the noise upon realizing that US submarines could conceal themselves from sonar detection by following the distribution of snapping shrimp. My limited (declassified) evidence indicates that Johnson’s predictions were indeed used for this purpose in the Pacific theatre.

**Author:** John Stachel

**Title:** The Historiography of Special Relativity: Partisanship, Politics, Poetry and Prejudice

**Abstract:** Controversies about the development of the special theory of relativity never seem to end. This paper will survey the place of partisanship, politics, poetry and prejudice in the discussion of such issues as the roles of: individuals and communities; theory and experiment; discovery, creation and invention; nationalism and internationalism, Einstein, Poincaré and Lorentz; Einstein and Marić. Some examples that will be discussed: during the Nazi time in Germany, in order to “Aryanize” it, supporters of the special theory referred to it as the work of Lorentz and Poincaré; while supporters of “deutsche Physik” damned it as the work of a Swiss Jew. Some scholars have asserted that it was the problem of synchronizing railway station clocks and timetables that led Einstein to the theory, while others emphasize his extensive
background in electro-technology and Maxwell theory. Some have asserted that the Michelson-Morley experiment led to the
theory, while others assert that it played no role. Some scholars have asserted that his first wife Mileva Marić did all the
mathematics for him, while others have denied that she played any role at all.

Author: Ida Stamhuis

Title: Use of Knowledge in Emerging Genetics: Strategies of Women 1900-1930

Abstract: Knowledge can be used in all kinds of ways. In a stratified society, getting educated and gaining knowledge is a
well-known strategy to emancipate. It was applied by the lower classes to advance in society. Women could use it as well.
The second half of the nineteenth century was the period of the first feminist wave. Initially, women had no access to
universities. Around 1900 this barrier was overcome, and some women received a university education. These women looked
for suitable jobs. In the academic system, genetics was not yet a prestigious discipline. In the early 20th century quite a few
women were active in this emerging field. However, compared to their male colleagues, these women often had inferior
positions. Being well-educated was apparently not sufficient. My paper will discuss the strategies open to women to use their
knowledge and abilities in consolidating or even improving their position in the discipline of genetics. It is important to
realize that, at the time, genetics was not a monolithic knowledge field. Women could choose to work in an established area
of genetics, which, properly done, could result in a satisfactory position. Or they could opt for an as yet unoccupied niche. In
this way they could become more visible, but they also ran the risk of sideling themselves. I will give several examples of
women geneticists, discuss the research strategies they applied and their successes or failures.

Author: Laura Stark

Title: Making up human subjects: Participants in NIH drug research, 1959-1979

Abstract: World War II marked a turning point in the history of research ethics. Historians of science and medicine
recognize the Nuremberg Code as the first modern code of ethics for research on healthy and sick human beings, presenting
the ensuing thirty years in the United States as a steady, if inelegant, march to the first American human subjects regulations
and principles. Recent scholarship has attended to researchers’ formal and tacit rules of conduct during this period, but in so
doing it has embedded in the historiography a protectionist repertoire of assumptions, codes, and vocabularies derived from
bioethics—itself a historically and culturally specific discourse stemming from the 1960s. One result has been the historian’s
production of a standard research subject in history. This paper reconsiders the conception of research participant-subjects as
coherent and uncomplicated historical actors. We focus on two NIH research sites: the Addiction Research Center in
Lexington, KY and the Clinical Center in Bethesda, MD. We examine testimony from participant-subjects, and transcripts
and reports from researchers’ discussions of participant-subjects between 1959 and 1979. We show that subject-participants
were only able to constitute themselves as “exploited subjects” starting in the late 1960s, which retrospectively recast their
understandings of their earlier experiences in drug studies. We argue that the ways participant-subjects and researchers
comprehend and frame their experiences is the product of the historical moments, material conditions, and social relations in
which they give account of their experience, not the moments in which the experience took place.

Author: Jennifer Steenshorne

Title: Ars et Scientia: the Van Der Guchts and Artistic-Scientific Networks in the First Half of the
Eighteenth Century

Abstract: Linnaeus, in his Incrementa Bontanices (1753) criticized the excessive cost of botanical books laden with rich
copperplate engravings. One of the titles he mentioned was Sir Hans Sloane's Natural History of Jamaica. Indeed, these two
volumes are notable, and perhaps even bought at the time-- for their engravings, done by Michael Van Der Gucht, based on
drawings by a Reverend Moore and Everhardus Kickius. These engravings, and his association with Sloane, made Van Der
Gucht!'s career. He and his sons, including the famed engraver and draughtsman Gerard Van Der Gucht, continued to work
for Sloane and his protégées, as well as anatomists such as William Cheselden. Just as the Van Der Guchts gained prestige
and legitimacy from their association with Sloane, so subsequent medical and natural historical authors gained prestige and
legitimacy from their association with the Van Der Guchts. Indeed, advertisements for certain works featured their names
before that of the authors. For example, Sloane sponsored the exterminator John Southall!?s work on the bedbug, entitled
"Treatise of Buggs," which prominently featured Gerard's engraving of the life-cycle of the creature, and the artist is thanked
along with Sloane. This paper will examine the Van Der Guchts and their engravings as central actors in the extended
scientific networks of the first half of the eighteenth-century.
**Author:** Claudia Stein  

**Title:** Bodies, Population, and Power: The Concept of Biopower and the Re-writing of Eighteenth-Century German History  

**Abstract:** Studies of eighteenth-century German political culture have moved away from the national state, opening up new areas of investigation. Interestingly, the natural sciences and medicine have been ignored in the transformation. This paper addresses how the history of science and medicine can be linked to these changes by examining how Michel Foucault’s concept of ‘biopower’ might be useful to this end. Foucault coined the term ‘biopower’ to account for a phenomenon, which he saw as central to the seventeenth- and eighteenth-century political imagination, the rise of the concept of population and the strategies and tactics for its management and control. What was new about this form of power was that it focused on the control and regulation of the human body. Concerns for the well-being and longevity of individuals became a concern in maintaining the collective prosperity of the political whole. With these general considerations in mind, this paper investigates two projects in the Electorate of Bavaria in the second half of the eighteenth century that took as their focus the well-being of the individual and the collective whole. One focused on women’s bodies and reproduction; the other, on food, nutrition and agriculture. Through the exploration of these projects, which bring the history of medicine and science together with the history of politics and economics, the paper throws a fresh look on the ways how the government of humans took on new forms during the eighteenth century.

**Author:** Alma Steingart  

**Title:** ‘It is almost a social distinction’: Constructing the American applied mathematician  

**Abstract:** “The difference between an applied mathematician and a pure mathematician is not the kind of mathematics he knows, it isn’t even whether he can create epoch-making new ideas…. The distinction resides instead in the nature of his interests; in his attitudes, not in his aptitude.” Thus Thornton C. Fry concluded a three-day conference in 1953 on the training of applied mathematicians. The conference, which brought together leading applied mathematicians and representatives of government and industrial organizations, sought to investigate not only how applied mathematicians should be trained, but just as importantly, to what end. If during World War II most American “pure” mathematicians were willing to abandon their academic departments and work on military projects, this was not the case at the end of the war, when many mathematicians returned to their prewar abstract research. In order to fill the demands made by the federal government and various industries, mathematicians and policymakers began calling for the establishment of a new sort of mathematical training. In this talk I examine the way contemporaries sought to construct the new professional identity of the applied mathematician. However, as Fry’s quote makes clear, often these discussions revolved less around the mathematician’s supposed expertise and more around his desired persona. This talk calls attention to the ways in which epistemological commitments and professional identities were embedded in pedagogical initiatives during the postwar period.

**Author:** Janet Stemwedel  

**Title:** Motivating Ethical Science from the Inside: How Philosophy of Science’s Knowledge-Building Should Matter to Scientists  

**Abstract:** While ethics is a branch of philosophy about which scientists sometimes express suspicions, as it seems to impose values from without, philosophy of science focuses instead on the understanding of how scientific practitioners build bodies of reliable knowledge about the world. I argue that the best point of entry for motivating ethics in science is an examination of how ethics is necessary in scientific knowledge-building, since good knowledge-building is something scientists value. On the surface, scientists might assume that the ethical requirements for good knowledge-building are minimal: Don’t lie when reporting scientific results or the conditions under which they are obtained. However, recent work in the philosophy of science has explored the ways that scientific knowledge-building depends on a well-functioning epistemic community, as well as the ways that the knowledge-builders negotiate sharing a world with non-scientists. I make the case that lessons about scientific knowledge-building drawn from the philosophy of science can motivate a more robust set of ethical considerations that support the community of knowledge-builders and foster more harmonious relations with the non-scientist segments of society. Further, I argue that framing ethics in terms of scientists’ own goals qua scientists can transform the scientists’ approach from one of compliance with regulations imposed from without, to one in which ethical behavior is an essential ingredient in how reliable knowledge gets built.
**Author:** Hallam Stevens  
**Title:** GenBank and the role of big data in biology  
**Abstract:** GenBank, the world’s preeminent DNA sequence database, has come to represent the new modes of computational and informatics biological work. Now containing over 150 billion base pairs, the database also exemplifies the role of ‘big data’ in contemporary science. GenBank was built by members of the Theoretical Division at Los Alamos National Laboratories. Walter Goad, the eventual leader of the GenBank project, was trained at Los Alamos in the application of numerical and statistical methods to bomb-physics using computers. In the 1950s, he used Monte Carlo simulations and the numerical solution of differential equations to model fluid flow and transport phenomena inside hydrogen bombs. During the 1970s, the Theoretical Biology and Biophysics Group (T-10) developed ways of applying many of the same statistical, numerical, and computational methods to bear on problems of comparing, storing, retrieving, and analyzing DNA sequence information. This paper examines this pre-history of GenBank in order to shed light on the emergence of ‘sequence data’ in biological work. In particular, I argue that sequence data could only exist inside the computer. The statistical and numerical methods used by the T-10 group constructed sequence data as computer-based objects. This fact has had significant implications for how and where genomic biology could be practiced since the 1970s. More generally, the computer-based nature of data also suggests that big data practices in the sciences are inseparable from the structures of the algorithms, file systems, and databases that support them.

**Author:** James Strick  
**Title:** Reich's Bion Experiments and the U.S. State Department  
**Abstract:** Psychoanalyst Wilhelm Reich conducted experiments in physiology, trying to quantitatively measure Freud's "libido" in experimental subjects. This led him serendipitously into origin of life experiments on microscopic vesicles he called "bions," between 1936-1939 in Oslo, Norway. When Reich later came under investigation by the US government, his reputation for scientific credibility was assessed by the US Embassy in Oslo in 1952. The embassy officer was unusually objective and creative in interviewing sources, to evaluate Reich's theories about bions, the origin of cancer, etc. The results of his investigation will be discussed in the context of the larger controversy that surrounded Reich's experiments.

**Author:** Banu Subramaniam  
**Title:** Dividing up the Earth: Caste, Sustainability and Theories of Ecological Resource Partitioning  
**Abstract:** Since the early twentieth century, theories of resource partitioning have been important in the field of ecology. Such theories explain how natural selection enables diverse species to co-exist in shared habitats. According to theories of resource partitioning, species can co-exist when organisms partition the resources (space, nutrients and other biotic and abiotic resources) rather than out competing the other. This is enabled through specialization and niche differentiation such a niche segregation, niche separation, and niche partitioning. With the rise of the importance of sustainability in the ecological literature in the 1980’s, Madhav Gadgil and other ecologists in India have proposed that societal segregation around lines of caste have served as a mechanism of ecological resource partitioning leading to ecologically more sustainable and diverse habitats. Arguing that caste segregation serves as a model of “traditional” and “indigenous” resource management systems, these scientists herald the sustainability of such a model while downplaying the systematic violence and resource deprivation that such systems of segregation have created for those relegated by birth to the lower rungs of caste hierarchies. In this paper, I examine how Indian scientists have used ecological theories of resource partitioning to valorize caste politics as important indigenous systems that sustain diversity and ecological sustainability. I also explore their many critics and the debates that ensued in their wake.

**Author:** Ajantha Subramanian  
**Title:** Engineering Caste Subjects in Indian Technical Education  
**Abstract:** Until the early 20th century, the British Indian engineering corps consisted almost exclusively of the graduates of metropolitan, not colonial, institutions. It was only with the expansion of public works in India that the colonial government began its concerted investment in formal technical education for Indians. Even at the outset, the question of what kind of training this would be, and what kind of man was suited for it, was hotly debated. Colonial officials and nationalists expressed a range of views on the purpose of technical education, whether it should emphasize skill enhancement for artisans to bolster flagging handicrafts, industrial training to promote indigenous industry, or engineering education to produce native
staff for government public works. These differences were especially pronounced in the Madras Presidency where the form and trajectory of modern technical education was debated with explicit reference to a colonial sociology of caste. Here, the distinction between the trades, industrial labor, and professions was not only a technical one; it rested on understandings of caste labor and intellectual ability. In this paper, I argue that the emerging link between caste and skill substituted a caste glass ceiling for a racial one, with technical knowledge increasingly associated with membership in particular caste groupings. Rather than being offset by the expansion of engineering education in the postcolonial period, institutional stratification only reinforced the relationship between caste and knowledge, only now the language of “merit” came to stand in for explicit references to caste.

Author: William Summers

Title: Not Quite a “Eureka moment.” Reception of the DNA structure by the American Phage Group

Abstract: The canonical account of the reception of the three papers of April 1953 describing the double helical structure of DNA is one of immediate and enthusiastic acceptance, a “Eureka Moment” in science. In the triumphalist narrative, it was a short step for Meselson and Stahl to confirm that the reproduction of the DNA was “semi-conservative” followed by the “decoding” of the DNA by Nirenberg and Ochoa. This simple, linear account, however, is clear only in retrospect. For several years after 1953, scientists close to the struggle to resolve difficulties and objections, not excluded by the data, and keep alive skepticism about the model. One key issue, noted in some histories, was the “untwiddling problem,” the puzzling problem of how plectonemically intertwined strands could separate fast enough for chromosome reproduction. Some alternative models rejected the plectonemic model of Watson and Crick in favor of side-by-side (paranemic) association of the two strands. One key approach at the time studied the material transfer of parental DNA to progeny DNA in bacteriophage reproduction. No laboratory, however, was able to account for more than 50 percent of the parental DNA appearing in the progeny. This parent-progeny experiment, now having receded into the historical background, was taken very seriously at the time and stimulated several alternative models for DNA function. This paper aims to provide a more detailed and complex account of this period of DNA history based on recent archival research.

Author: Mary Sunderland

Title: Making Ethics a Part of Engineering

Abstract: The development of engineering ethics education during the second half of the twentieth century helped to demarcate the role of the engineer from that of the scientist. This paper examines the incorporation of ethics into engineering curricula as a window onto the changing societal role of the engineer. A historical analysis of the day-to-day mechanics and institutional dynamics involved with implementing ethics education is provided to bring into focus the infrastructure that both supports and constrains pedagogical change. This essay focuses especially on the engineering programs at the University of California (UC), Berkeley, and the University of California, Los Angeles. Although both are part of the larger UC system, these institutions represent different kinds of engineering schools, situated in different industrial and cultural environments. Studying the history of ethics education comparatively across different institutional settings brings the role of local circumstances and contingencies into conversation with broader cultural and institutional changes, and also raises questions about how and why engineering ethics established itself as distinct from other emerging ethics fields. Curricular changes communicate, both explicitly and implicitly, educators’ efforts to define and redefine engineering in relation to changing social and scientific arenas.

Author: Abha Sur

Title: Caste-distance, Affinities, and Anxieties in Indian Anthropometry, 1920-1960

Abstract: The June 1958 volume of Sankhya: The Indian Journal of Statistics is devoted to the analysis of the Bengal anthropometric survey of 1945. Coauthored jointly by the social anthropologist, D. N. Majumdar, who carried out the measurements on various castes, tribes, and religious groups, and C. R. Rao, who provided statistical analysis of the measurements, the study offers a glimpse into the science of race and caste in mid-twentieth century India. Although, by this time the use of anthropometry in taxonomy had been largely discredited, the authors remained strong proponents of it despite their misgivings about “suspicious” readings and discrepancies in caste assignments. Indeed, Majumdar insisted that, “Whatever arguments may be advanced against the usefulness of anthropometry as a tool to explain the existing, and almost accepted, social hierarchy, it has been demonstrated on more than one occasion that … the correspondence between physical pattern and social stratification is not merely fortuitous.” Anthropometric studies in India were revitalized by P. C. Mahalanobis who developed the concept of caste-distance, which measured the degree of resemblance between castes by using multivariate statistics. In this paper, I examine critically the collaborative work of anthropologists and statisticians...
fostered by Mahalanobis to posit that perhaps more that caste resemblance, caste-distance seemed to measure caste anxieties of the anthropologists.

Author: Peter Susalla

Title: Relativity and Astronomy at Caltech and Palomar, 1948-1961: How Allan Sandage Learned his “Two Numbers”

Abstract: The American astronomer Allan Sandage (1926-2010) called the practice of cosmology from the 1950s through the 1970s the “search for two numbers:” the expansion rate of the universe, H0, called the “Hubble constant,” and the rate the expansion changes over time in certain cosmological models, q0, sometimes called the “deceleration parameter.” Knowing these two values, Sandage argued, allowed astronomers to test between such models. In framing, executing, and interpreting cosmological tests, Sandage was bridging the concepts and practices of three different fields in which he had been trained as a graduate student at Caltech in the late 1940s and early 1950s: mathematical physics, theoretical astrophysics, and observational astronomy. From his teachers H.P. Robertson and Fred Hoyle, Sandage learned the theoretical structures of relativistic and steady-state cosmologies and helped them to develop the methods of testing these models, and from Edwin Hubble and Milton Humason he was trained to collect cosmologically relevant data at the telescope. Through his thesis work with Walter Baade (and a “pre-Ph.D. postdoc” with Martin Schwarzschild at Princeton), Sandage developed a deep appreciation for understanding how stars, star clusters, and galaxies evolve over time, particularly as these objects served as the “test particles” that marked the geometry of the cosmos and revealed, Sandage hoped, its evolutionary history and future. Sandage’s research from 1955-1961 shows him translating and working out the tensions between these different sources of knowledge and expertise in order to make the practice of cosmology meaningful to his principal audience of observational astronomers.

Author: Edith Sylla

Title: Three Cases from Medieval and Early Modern Mathematics and Their Interrelations

Abstract: Many points in Sarton’s The Study of the History of Mathematics ring as true today as they did when the book was first published in 1936. The value of historical knowledge, he wrote, is a function of its accuracy, but the purpose of the history of mathematics is not “merely to exhibit one’s mastery of a difficult technique, but rather to apply that technique to the attainment of a deeper understanding of mathematics and a better appreciation of the humanities implied.” While “the more immediate past of mathematics cannot be explored with profit except by a professional mathematician,” scholars with historical as well as mathematical expertise may be required for the investigation of earlier mathematics. This talk will consider three episodes from medieval and early modern mathematics in light of what Sarton had to say, namely, 1) the history of the use of ratios and proportionalities in the science of motion stemming from Thomas Bradwardine’s De proportionibus velocitatum in motibus (1328); 2) the interrelations between the mathematics of deferents, epicycles, and , on the one hand, and physical orbs, on the other, in Georg Peurbach’s Theoricae novae planetarum (1472); and 3) the founding of mathematical probability in Jacob Bernoulli’s Ars Conjectandi (1713). These episodes exemplify Sarton’s recognition that one of the most valuable aspects of the history of science is the study of the interrelationships between different branches of mathematics and science and their mutual enrichment.

Author: Alison Syme

Title: Floral Embassies

Abstract: Drawing on H. G. Wells’s short story “The Flowering of the Strange Orchid” and other tales of predatory plants, this paper considers nineteenth-century fictional accounts of floral bodies that (re)create their environments in other climes. These plants act as embassies of other milieux in multiple senses: they are simultaneously representative bodies, messages, and “other” spaces within a territory (spaces which the plants inhabit and create, and which foreign bodies may enter and help sustain). Such floral embassies challenge and captivate their would-be collectors, who engage with their vegetal counterparts in material ways that reveal the psychosexual, somatic, and political stakes of transplantation and territorial contestation. In these tales humans become, or narrowly avoid becoming, natural resources, while vegetables have mobility and colonial agency. Fiction here draws on real practices, desires, and dangers to explore the consequences of refusing to recognise the inseparability of bodies and environments.

Author: Kae Takarabe
Title: “Scientific Practice in Japan: A Case Study of EMA Saiko, 1787-1861”

Abstract: The Tokugawa Shogunate established the feudal system which lasted for more than 250 years and was characterized by isolationism. Within this system, women were marginalized. Honzogaku is originally a study of medicinal plants, animals, and minerals—in a broad sense, natural history. In this context, few women produced mainstream Honzogaku work, but they were not completely absent from the scene. In “Sekiheki Ki” written in 1847, EMA Saiko (1787-1861) wrote about the case of a female patient of her nephew EMA Gen’eki. A small black stone came out from the patient’s purulent armpit while she was undergoing an operation. Saiko described the details: the year of the medical treatment, the age and sex of the patient, symptoms, prescription, progress after prescription, form of the stone, and the cause of the disease. She supplemented this case with another similar case. “Sekiheki Ki” was proofread by a doctor KANDA Ryukei, one of her colleagues in her hometown area of Mino. Saiko was not a professional scientist; however, she participated in the margins of Honzogaku. Saiko’s talent in Chinese poems and paintings enabled her to participate in poet-circles, where Saiko gradually came to establish friendly relations with doctors such as KANDA Ryukei. Saiko cultivated her scientific knowledge from these doctors as well as from her father and nephews.

Author: Wei Yu Wayne Tan

Title: Needles, Texts, and the Anatomy: Towards a Cross-Cultural Understanding of Acupuncture in Seventeenth-Century Japan

Abstract: In 1683, the Dutch physician Willem Ten Rhijné’s medical treatise De Acupunctura was published in Europe, making him the first to provide a full account of acupuncture for European audiences. In his work, Ten Rhijné recorded the theories and techniques of acupuncture, which he witnessed and understood with the help of translators during his stay in Japan from 1674 to 1676. While acknowledging the value of the work, recent scholarship has largely faulted Ten Rhijné for his forced interpretations of acupuncture using European medical theories and his anatomical misrepresentations of acupuncture points. Despite these flaws, I propose that Ten Rhijné deserves recognition for one overlooked contribution – he left behind important details for understanding the budding development of Japanese acupuncture as a distinct tradition from Chinese acupuncture. In this paper, I will first examine the rise of acupuncture as a medical profession in Japan during the 1600s, and highlight key continuities with Chinese thought and practices. I will then compare passages from De Acupunctura with Japanese acupuncture treatises in circulation at that time and discuss specific innovations in Japanese acupuncture. In particular, my analysis will focus on the significance of Ten Rhijné’s observations of the use of acupuncture needles and the surprising correspondences with Japanese anatomical maps. Also, by relating this inquiry of acupuncture in seventeenth-century Japan to the early modern global context, I will address the role of texts in the cross-cultural transmission of medical and scientific knowledge within East Asia as well as from East Asia to Europe.

Author: Simon Taylor

Title: “Humanist with an Ontological Attitude”: On Kurt Goldstein’s Anxious Brain

Abstract: Over the course of a medical career spanning almost half a century, the German-Jewish neurologist Kurt Goldstein made significant contributions to the fields of psychiatry, psychology, and neurology. One of the defining features of Goldstein’s approach to physiology is his holism: in contrast to the localized perspective prevalent at the beginning of the twentieth century, Goldstein conceived of the brain as an integrated whole. It has long been recognized that Goldstein’s holistic approach to organismic functioning owed much to the general philosophical currents of his time, especially existentialism and phenomenology. In this paper I argue that Goldstein’s theory was decisively shaped by philosophical discourses on anxiety, and that it was precisely through an engagement with philosophy that he was able to arrive at a new understanding of the brain. As the director of Frankfurt’s Military Hospital for Brain Injured Soldiers from 1914-1931, Goldstein treated hundreds of patients with war-related neurological injuries, many of whom experienced what he termed “states of catastrophe,” overwhelming bouts of anxiety that trigger a profound existential crisis in the patient. Disorienting though these states were, Goldstein held that they were indispensable to a patient’s recovery: without anxiety, the organism was incapable of coming to terms with, and overcoming, its injury. “Thus,” he concluded, “the phenomenon of anxiety occupies an important place in the whole process of coming to terms with the organism with the world.” In this way, Goldstein situates anxiety at the centre of a comprehensive account of the meaning and significance of biological life.

Author: Mary Terrall

Title: Réaumur’s Assistants: Bridging the Gap between Natural History and Experimental Physics

Abstract: This paper addresses the session’s theme through the work of R-A F. de Réaumur (1683-1757), who occupied a
central position in French science in the first half of the eighteenth century. For decades, Réaumur produced a steady stream of books and papers, ranging in subject matter from natural history and thermometry to the manufacture of steel, paper and porcelain, to ornithology and agronomy. To represent this diverse output as the work of a polymath versed in many disciplines is to miss the many ways in which these subjects were intimately related, especially through techniques, instruments, and attitudes. In the paper, I pay particular attention to the operation of the household where Réaumur and an ever-changing cast of assistants and collaborators performed their experiments and observations, to show how the division between natural history and what the French called 'la physique' (roughly, natural philosophy) vanishes in this context. Réaumur’s home, with its laboratory/workshop, study, library, garden and collections, was the training ground for a series of young men who went on to perpetuate experimental natural history and applied physics in a variety of formats and venues, from public lectures to academic papers to scientific expeditions to collections of various kinds. I will choose a few examples from the work of Guettard, Brisson and Hérissant to illustrate this complex of physics and natural history, with reference also to the programmatic statements of Nollet.

Author: C. Michele Thompson

Title: Discovery as Disaster: the Fate of the Saola and of the Peoples Who Know It Best

Abstract: The saola, Pseudoryx nghetinhensis, is a ‘new’ animal ‘discovered’ in the highlands between Laos and Vietnam in 1992. It is one of the rarest and most endangered mammals on earth. No scientist has ever seen a living saola in the wild, but at least fifteen have died after being captured for scientific study. In the case of the saola scientific discovery and investigation may be contributing directly to species decline. Further, the discovery of the saola gave the government of Vietnam unprecedented international support for measures regulating the terrain containing the range of the saola and controlling the highland peoples who live there. As a consequence these peoples have been almost completely disenfranchised with regard to any ‘rights’ to the saola or to other forest products from the territory it inhabits. This essay will examine the archaeological and textual record of the long acquaintance between the peoples who inhabit the geographic space that is now Vietnam and the saola. This essay will move on to a discussion of the first twenty years of publication and research on the saola, and on the results of these activities for the scientists involved, for the saola as a species, and for the minority peoples who have been most affected by the national, regional, and international interest in the saola. It can be argued that for the saola and for its closest human neighbors that its ‘discovery’ has had disastrous consequences.

Author: Courtney Thompson

Title: The Murderer and the Phrenologist: Constructing Body Expertise in Nineteenth-Century Prisons and Courts

Abstract: Phrenologists in the early nineteenth century conceived of crime as an important space for the negotiation of expertise over the body and mind. In their writings and lectures on criminals, they staked their claims as experts able to interpret the skull, and hence the mind and actions of dangerous individuals. However, phrenologists were not only interested in participating in discourses around criminality; they also inserted themselves into the penal system, using it as a platform for extending their professional goals. The fathers of phrenology, Johann Spurzheim and George Combe, made widely-publicized visits to prisons in Europe and the United States, to exhibit their abilities to select the most dangerous minds and explain their actions. Others examined executed prisoners post-mortem, thus demonstrating their abilities for prison officials, policy makers, and the public. While efforts to introduce phrenology into the world of penal policy were less than successful, phrenologists were called to take the stand in criminal cases in 1830s and 1840s America. In trials such as those of Major Marshall in 1834 and John Haggerty in 1847, phrenologists testified as expert medical witnesses. In this paper, I explore the various strategies of phrenologists for acquiring a public and professional reputation for expertise both within penal institutions and on the stand, as well as the eventual shift in the status of phrenology from controversial evidence (in the 1830s) to generally accepted expert testimony (in the late 1840s) in criminal cases.

Author: Jenna Tonn

Title: For collecting a bathing suit and sneakers are indispensable’: Summers at the Bermuda Biological Station, 1903-1926

Abstract: Scholars have long pointed out the migratory patterns of biologists flocking to the seaside for summer work. Studying natural history at Penikese Island, Annisquam, and Woods Hole supplemented coursework in zoology, provided living organisms for marine research, and removed naturalists and their families from the oppressive urban summers. This paper takes up the Bermuda Biological Station, founded in 1903 by Edward Laurens Mark of Harvard University, Charles Bristol of New York University, and the Bermuda Natural History Society, as its object of inquiry. As a site for summer
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science, the Bermuda Biological Station filled its early ranks with seasoned biologists, motivated school teachers, and adventurous interested parties. In later years, the research station’s community became more narrowly identified with a particular type of “professionalizing” biologists. Yet in its early history, the Bermuda Biological Station provided a complicated spectrum of scientific possibilities for its temporary residents living and working at the Hotel Frascati. Along with examining the heterogeneous identities and practices of the Bermuda Biological Station researchers, this paper takes up questions related to subjectivity and the “delights” of scientific observation at the seaside.

Author: Alain Touwaide

Title: Bibliography in the History of Science: What’s next?

Abstract: Over the past century, bibliography in the history of science has moved from retrospective and yearly print volumes (including George Sarton’s encyclopedic efforts) to the Internet as a huge bibliographic resource. In its most advanced form, the Internet allows infinite and instantaneous possibilities together with ubiquitous sources. Results change from one search to another in a way that almost dilute the very concept of bibliography. In this paper, I will take a look at the recent evolution of bibliographical research through the analysis of a representative sample of publications in the field of ancient history of science. On this basis, I will try to extrapolate what the next developments might—or should—be. If we redefine bibliographical research in relation to technical possibilities, it has an exceptional opportunity to become more relevant than ever and to generate new forms of history of science.

Author: Daniel Trambahiolo

Title: Mercury Drugs as Objects of Knowledge in Tokugawa Japan

Abstract: Mercury compounds were an important part of the therapeutic repertoire in eighteenth and nineteenth-century Japan. Although mercury compounds were used most widely for treating syphilis, many physicians also prescribed them for a number of syndromes, particularly those that were difficult to treat using other remedies. Mercury compounds were used by practitioners of both Chinese and European styles of medicine, and were thus referred to by a bewildering variety of Chinese and Dutch names, the relationships among which were not always clear. The resolution of these ambiguities required not only linguistic mediation, but also the development of more subtle understandings of the similarities and differences in their properties and of the practical procedures involved in their manufacture. This paper will analyze surviving manuscript and printed accounts of mercury drug production from late eighteenth and early nineteenth-century Japan, using the material histories of these drugs as a starting point to examine the relationships between understandings of disease, the classification of therapeutic substances, and the local and global commercial environments in which doctors operated.

Author: Henry Trim

Title: Forward to the Past: Forecasting Continuity in Energy Debates During the 1970s

Abstract: The energy crisis and neo-Malthusian predictions of collapse made permanence a central concern for American environmentalists in 1970s. Convinced that humans would soon cause global ecological collapse a group of countercultural scientists at the New Alchemy Institute sought to provide a solution. To them the science of ecology seemed to offer a solution as it illustrated how ecosystems used feedback systems to maintain long-term stability. Drawing on the work of ecologists Howard and Eugene Odum as well as NASA’s experiments with cabin ecology, the New Alchemy Institute attempted to redesign humanity’s relationship with nature and technology. The New Alchemy Institute’s designs melded human, environment, and machine into self-sufficient systems, which they believed could maintain ecological sustainability. Calling these “living machines,” “Arks” the New Alchemists argued they fit within the stable bounds of the world’s ecosystems and had the potential to save the world from environmental catastrophe. In the 1970s, the New Alchemists built two of these house sized “Arks”, on Cape Cod and on Prince Edward Island. My talk will use the New Alchemists’ intriguing work to examine the influence of systems ecology on environmentalism in the 1970s. Drawing upon the New Alchemy Institute’s failure to achieve the impossible goal of self-sufficiency and ecological stability my talk illustrates the problematic legacy of ecological science’s emphasis on satiability and continuity in the 1970s.

Author: Elly Truitt

Title: An Irrational Fear of Magic

Abstract: Magic and the "occult sciences" are often overlooked within the history of science or dismissed as pseudo-
scientific and wrong-headed. The importance of alchemy is often framed in the context of the origins of chemistry; the complexities of predictive astral science are easily dismissed as astrology. This approach relies on an assumption that medieval science is interesting or important only insofar as it contributed to modern science, and effaces both the underlying rationality of medieval magic and its importance in the court, the cloister, and the classroom. In the medieval Latin West, magic and natural philosophy were part of the same intellectual endeavor to understand, explain, and categorize the laws that governed natural objects and processes. The integration of the many forms of divination and farcasting or mastering the mysterious powers of gemstones and animal parts are intimately bound up with Aristotelian and Arabic textual knowledge. I contend that we must revisit the importance of magic and the "occult sciences" in the history of science from 1200-1700, and reintegrate magic into medieval and early modern natural philosophy.

**Author:** Jonathan Turner

**Title:** IR, OR and DND: The Integration of Canada’s Department of National Defence

**Abstract:** Jack Granatstein, in *Who Killed the Canadian Military?*, identifies Minister of National Defence Paul Hellyer as a key culprit for the integration of the Department of National Defence (DND) from 1964 to 1968. For military historians like Granatstein, the integration process is representative of all that is wrong with Canadian politics on the military question—underfunding, abrogation of international obligations and alliances, and destruction of esprit de corps. Most other Canadian historians call Hellyer’s decision ‘unpopular.’ In this presentation I will analyze the decision-making process leading up to integration as an example of Canada’s relative position within the Atlantic Triangle, and the exchange of scientific and technical information, operational research specifically, between allies. The first step towards integration was the solicitation of external business expertise in the form of the Royal Commission on Government Organization led by J. Grant Glassco, which was nicknamed ‘The Canadian Hoover Commission’ for its similarities to the Hoover Commission and for its consultations with former President Herbert Hoover. The Glassco Commission recommended integration within DND headquarters as a way to save money. Hellyer sent this recommendation to operational researcher Robert Sutherland for further consultation; Sutherland studied the British move to a single Department of Defence, and was enraptured with Robert McNamara’s application of systems analysis throughout the American Department of Defense. The resulting integration of DND is representative of Canada’s junior-follower role in the tripartite, the pervasiveness of operational research following the war, and the exchange of operational research expertise between governments and industries.

**Author:** Nancy L. Turner

**Title:** Alchemical Cosmology and the Quest for Unity in the Fifteenth and Sixteenth Centuries

**Abstract:** Although the corpus of hermetic writings and its close companion alchemy were both (generally) taught and practiced outside the walls of universities and ecclesiastical institutions, in the course of the fifteenth and sixteenth centuries many ideas that originated in the alchemical worldview were incorporated into the writings of intellectuals trained within traditional religious and academic contexts. The German Benedictine abbot Johannes Trithemius (d. 1516) contributed to the study of alchemy by arguing that the most famous passage from the Emerald Tablet of Hermes Trismegistus—“What is below is like that which is above, and what is above is like that which is below”—should not be understood simply as an alchemical recipe for transforming base metals into gold; according to Trithemius, full understanding of this passage leads to the realization “that all things flow from the one thing, from the goodness of the One.” The sixteenth-century polymath John Dee (d. 1609), who as a young man taught mathematics at the University of Paris, fastened with a passion upon Trithemius’s emphasis on the unity in the universe that can be discerned through mastery of the hermetic corpus. After reading Trithemius’s works, Dee famously created a single symbol—his hieroglyphic monad—that he argued describes the interconnectedness of all objects in the universe, material and non-material, celestial and terrestrial. Dee’s contemporary Giordano Bruno (d. 1600) joined Dee in emphasizing the importance of recognizing the unity that exists between earthly entities and the greater entities of the cosmos.

**Author:** Roger Turner

**Title:** Infrastructural Science: Stabilizing Socio-Technical Systems through Routinized Scientific Observation and Prediction

**Abstract:** This paper develops a theoretical perspective for understanding how science stabilizes the complex socio-technical systems that underlie the lifeways characteristic of industrialized societies. I describe a set of criteria historians can use to identify “infrastructural sciences:” sets of highly routinized, rarely celebrated technical practices that are central to industrial life. To reliably deliver water, food, energy, goods, and information, technical workers must continually adjust large technological systems to the changing external environment; operating the infrastructures that environmental historians call...
"second nature" requires monitoring "first nature." This surveillance turns geographically-distributed, standardized observations into formulaic reports and forecasts—texts like weather forecasts, water quality assessments, and stream flow updates. Because of the discipline and expense required to produce these public goods, most modern states pursue environmental surveillance as a basic aspect of governance—like national meteorological services, hydrological monitoring, or geological mapping agencies. Though the infrastructural sciences are culturally modest (they make few claims about what it is to be human or our place in the universe), they do have a complex relationship to theoretical science. Academic researchers guide what and how networks monitor, and they often make theoretical claims using data repurposed from industrial use. This paper illustrates my framework using examples from meteorology, economic entomology, and tidal science in the 19th and 20th centuries. By drawing our attention to routine observation used for commerce and governance, infrastructural science reveals the importance of institutions, scientists, and work practices rarely noticed in existing historiography.

Author: Mark Ulett

Title: The Energy of Evolution: Edward Drinker Cope and the Nature of Variation

Abstract: Edward Drinker Cope was one of the great nineteenth century American evolutionists. His insatiable lust for dinosaur fossils, quixotic intellect, and public hatred of Othenel Marsh are perhaps his most memorable qualities. However, it is easy to overlook his complex theory of heredity and evolution. Beginning in 1868, Cope developed a complete theory that incorporates elements of Weismann’s germ-plasm theory, recapitulationism, neo-Lamarckism, orthogenesis, and neo-Darwinism. His theory is fully mechanistic despite using a complex categorization of “energies of evolution,” a term that sometimes signals vitalism. The resulting theory defies easy categorization within the traditional eclipse of Darwinism narrative. My paper analyzes the core logic of Cope’s theory of heredity and evolution put forth in Primary Factors of Organic Evolution (1896). Put simply, his theory focused on the flow of energy between 1) the soma and germ-plasm and 2) an organism and its environment. I argue that his primary concern was explaining the origin of morphological variation, the foundation on which he built subsequent aspects of his theory. Other thinkers shared his emphasis on the role of variation as central to explaining evolutionary causation. Analyzing Cope’s argumentative strategy adds new dimensions to the various attempts to synthesize and contest intellectual authority over evolutionary theory at the turn of the twentieth century.

Author: Mel Usselman

Title: Atomic Theory and Multiple Combining Proportions: Some Things Just don't Add Up

Abstract: John Dalton’s atomic theory, with its postulate of compound formation through atom-to-atom combination, brought a new perspective to the weight relationships among combining elements. A presumed one-to-one combination of atoms A and B to form a simple compound AB allowed Dalton to construct his first table of relative atomic weights from literature analyses of appropriate binary compounds. For such simple binary compounds, the atomic theory had little advantages over affinity theory as an explanation of fixed proportions by weight. For ternary compounds of the form AB2, however, atomic theory made specific predictions that were not an essential component of affinity theory. A necessary consequence of atomic theory was that the weight of B in the compound AB2 be exactly twice that in the compound AB. Dalton himself, together with Thomas Thomson and William Hyde Wollaston, all published within a few years of each other experimental data that claimed to give the predicted results with satisfactory accuracy. There are nonetheless several practical barriers to obtaining multiple proportions with the predicted integral values. In this paper I will discuss replication experiments which demonstrate that only Wollaston’s results are experimentally reliable. It is likely that such replicability explains why only Wollaston’s experiments were validated by other contemporary chemists.

Author: David Vail

Title: Spraying the Airplane Way: Fred E. Weick, the Ag-1, and the Emerging Science of Aerial Application

Abstract: The aerial application of pesticides increasingly became a central part of the United State’s post-World War II agricultural landscape. From the emerging concepts of chemical toxicity and plant pathology to aeronautical professionalization, the history of aerial spraying stands as a crucial intersection in the evolution of agricultural science. Each discipline has rural origins that shaped their national legacies. This paper examines the numerous links between efforts by farmers, pilots, and agriculturalists in the Great Plains to study the technological and ecological effects of pesticides and growing federal attempts to regulate chemical dispersal rates, study toxicity, and oversee aeronautical practices of pilots across the country. These forces culminated in the 1950s with Fred E. Weick guiding a collaboration between the United States Department of Agriculture, Civil Aeronautics Administration, and the Personal Aircraft Research Center at Texas A&M College to design a standardized agricultural spray plane (the Ag-1) that kept pilots safe, fields healthy, and
communities from harm. The input from numerous Great Plains pilots, regional spraying handbooks, conferences, and agriculturalists’ reports all culminated in federal guidelines (both USDA and EPA) based on an aerial spraying science that had as many rural origins as laboratory ones. Ultimately, Weick’s experimental prototypes and his efforts to integrate practitioner input helped formalize the standards landowners, pilots, agriculturalists, and policymakers would hold regarding toxicity and risk when applying chemicals in the region and throughout the nation.

**Author:** Joppe van Driel

**Title:** The Fat of the Land: Oeconomic chemistry in late eighteenth-century Dutch agriculture

**Abstract:** In the second half of the eighteenth century agricultural productivity in Western Europe increased at an unprecedented pace. Generally, two success stories are invoked to explain this: one based on the success of capitalist economy, presenting enclosure movements as waves of privatization, allowing for innovation; one based on the success of science, ascribing economic interests to late-eighteenth-century farmers, leading them to apply new chemical theories and mechanical innovations to increase profits. Both stories fail to historicize the concepts of ‘economy’ and ‘science’. This presentation argues that: (1) Eighteenth-century agricultural innovation was part of a European-wide movement of ‘agricultural improvement’, conceptualized as an ‘oeconomic’ endeavor by contemporaries. (2) Here, agricultural practice was materially and conceptually interconnected with other local industries; accordingly, agricultural productivity should be analyzed as interconnected with industry. (3) Contemporary chemical theories enunciated generalized production rules that circulated among these interconnecting practices. Two agricultural sites within the provisioning zone of Amsterdam will illustrate these points: (A) The farm of the Amsterdam regent Frederik Alewyn (1737-1804); (B) The Bovenkerkerpolder, reclaimed in 1770 and directed by, among others, the Amsterdam regents Jan Bernd Bicker (1746-1812) and Joachim Rendorp (1728-1792). Here, increasing productivity was not about creation (of wealth), but about re-creation (of nutrients and labour). Chemistry was considered essential to this ‘oeconomic’ enterprise, as it was said to teach how to maintain a ‘proper proportion’ of the land's nutrients, yielding ‘sustainable profit’ by keeping the land ‘fat’.

**Author:** Geert Vanpaemel

**Title:** Rembrandt’s chemist: AP Laurie and the public science of art

**Abstract:** During the first decades of the twentieth century, the Scottish chemist A.P. Laurie (1861-1949) was considered a world authority on the scientific examination of paintings. Following his initial interest in ancient painting techniques and medieval pigment recipes, he became involved in the authentication of paintings and the detection of art forgeries. As his fame grew, he became more bold in his attacks on fraudulent or ignorant art dealers and connoisseurs. This culminated in his major work on Rembrandt in the 1930’s. Yet, as he was fully aware himself, the validity of his scientific expertise was not easily accepted in the art world. To support his claims, Laurie therefore often had recourse to the public domain. He wrote popular books and numerous newspaper articles, showing less restraint in his denunciation of the art world than in his scholarly writings. This paper will examine the role of media representation of scientific procedures as an independent argument in support of his scientific claims. I will argue that by making use of public statements, Laurie sought to overcome more easily the scholarly reluctance in dealing with scientific evidence. However, in the absence of a proper scientific community to back up his claims, Laurie’s work did not find the general acclaim he had hoped for.

**Author:** Joel Vargas-Dominguez

**Title:** Transnational Standards? Making 20th-Century Nutritional Knowledge across Mexico and the US

**Abstract:** Between the late 19th century and early 20th century, nutritional science emerged through various international efforts to harmonize terminology, techniques and methods of food analysis; a standardization driven by international trade interests among other factors. In this paper I analyze three moments in the construction of standards, which illustrate tensions between local practices, national identity, international organization and transnational dynamics: the study of basal metabolism by US researchers at a Carnegie Institution research center in Yucatan, the establishment of a National Institute of Nutriology (INN) in Mexico, and the production of nutritional tables by Mexican researchers aimed at exploring the composition of the Mexican diet. Each of these cases requires differentiated analysis, in which diverse grades of national, international and transnational elements are simultaneously present. The Carnegie center in Yucatan is an example of the hegemonic extension of US laboratory practices abroad. The INN was a space in which expert knowledge was negotiated through collaboration between Mexican and US scientists. The making of nutritional tables in Mexico offers a middle ground situation in which Mexican practitioners appropriated techniques and apparatus arising from US research and standardized in the international arena to clarify a problem that only had meaning in terms of national interest. The three cases display
different grades of collaboration that nonetheless engage standardized forms of knowledge already in place globally, thus showing that a more complex historiographical analysis is needed in order to grasp the density of historical phenomena.

**Author:** Pavel Vasilyev

**Title:** Juvenile Health in Besieged Leningrad and Soviet Medical Science, 1941-1950

**Abstract:** The siege of Leningrad during WWII resulted in a large-scale famine, becoming an unparalleled phenomenon in the history of public health. The purpose of this paper is to discuss Soviet scientific studies of the experiences of children and teenagers in the besieged city that were published during the war and in the immediate post-war years. While historical studies of children and teenagers during the siege have become an increasingly popular topic in post-Soviet Russia, most of them largely rely on personal documents, such as diaries, memoirs and recorded interviews with the survivors of the siege. My paper complements this perspective with a study of Soviet medical texts written in 1941-1950. The siege of Leningrad and the resulting juvenile health complications presented an extraordinary challenge to Soviet medical sciences, while at the same time serving as a major testing ground for nutritional science, pediatric endocrinology, psychiatry, and hygiene theories in particular. Scientific interest in juvenile health was also linked to the practical importance of teenagers for post-war industrial reconstruction and pressures to rebuild the Soviet labor force. This paper focuses on published medical texts as well as unpublished material from several St Petersburg archives. While extant studies of these Soviet medical texts discussed primarily their concern with physical parameters (height, weight, body proportions, constitution and the like), this paper will pay special attention to such aspects as nutrition, mental health, gender, and concern with the traumas of growing up in the besieged city.

**Author:** Helen Zoe Veit

**Title:** Children’s Food and the Science of Child Growth in the Progressive Era United States

**Abstract:** Spurred by a revolution in nutrition science, interest in maximizing children’s growth through diet intensified in the early twentieth-century United States, part of broad efforts throughout the Progressive Era and beyond to measure and improve the body in all its aspects. During this era, calorie studies were making it possible for the first time to compare eating habits across populations while life insurance data were revealing previously unsuspected correlations between body size and physical health. Meanwhile, anthropometric tables were tying concepts like “malnourished,” “normal,” and “perfect” to specific weights and heights, and sales of home scales – marketed as ways to assess and ensure health – were exploding. Physique had long been shorthand for social class in the United States, and a variety of organizations throughout the early twentieth century attempted to democratize physical growth. Public schools, orphanages, popular magazines, Better Baby Contests, the U.S. Children’s Bureau, and the American Medical Association were only some of the many institutions seeking to impress scientific food habits on parents and children in the name of maximizing children’s individual growth, enhancing national efficiency, and boosting so-called racial development. This paper will examine how food became one of the supreme tools for guiding children’s physical and mental development in this era, and how attempts to define an ideal childhood diet intersected with changing definitions of children’s food tastes and of childhood itself.

**Author:** Lilla Vekerdy

**Title:** Director

**Abstract:** Vekerdy is Director of Special Collections, the Smithsonian Institution Libraries who will talk on the resources of the collections and the available funding and fellowships. He interest is in ancient to early modern mss. and documents. And she will also talk about recent acquisitions.

**Author:** Jeremy Vetter

**Title:** Reframing Science from the Ground Up: Knowledge of Grass and Soil in the Making of the U.S. Great Plains

**Abstract:** In the early twentieth century on the U.S. Great Plains, during the decades leading up to the Dust Bowl, agricultural settlement boomed. Animal grazing was rapidly displaced by plowing up the land for grain production, although ranching persisted in some parts of the region. This paper asks how thinking about natural knowledge from the perspective of agricultural history reframes our understanding of the history of science, focusing on two key parts of the natural world that were crucial to the making of the Great Plains region from the ground up: grass and soil. Retelling the story this way has
many implications. First, and most basically, this reframing directs our attention to understudied sciences, including agrostology (grass science) and soil science, which were centrally important in the development of the region but which have been marginal to how the history of science has been told. Second, it directs greater attention to the connections between science and capitalism through such mechanisms as the rationalization of range resources through grass science and the valuation of land through soil science. Through cooperative arrangements involving state agricultural experiment stations and the U.S. Department of Agriculture, state-funded science played a key role in the political economy of capitalist development on the Great Plains, as elsewhere. Finally, this reframing of the history of science from the perspective of agricultural history provides opportunities for deepening our understanding of the interactions between expert scientists and lay people (farmers and ranchers) over a vast land domain.

Author: Jaipreet Virdi

Title: “Social Media as Public Participation”

Abstract: I addressed the importance of blogging as scholarship in a 2010 issue of the HSS newsletter, acknowledging that blogs have an ability to stimulate conversations not available in traditional fora, as well as create new aspects of a scholarly culture spearheaded by the open access movement. Blogging, tweeting, and other forms of social media are essentially forms of public participation. By transmitting information otherwise confined in the ivory tower, social media allows for a wider readership to become visible—readers become conversers, and public engagement allows for a free exchange of ideas beyond disciplinary and academic boundaries. In some cases, such communication can even provide access to rare scholarship, as in my own personal case when a descendant of a historical figure focused in my dissertation contacted me with her family’s personal papers and materials.

Author: Jaipreet Virdi

Title: Cotton-Wool vs Vulcanized Rubber: Expertise and the Artificial Tympanum Controversy

Abstract: The artificial tympanum (eardrum) is a device used to remedy a perforation in the membrane of the eardrum preventing proper function, by maintaining air pressure and preventing excessive discharge. Various materials were proposed for constructing an artificial membrane throughout the centuries, including pig’s bladder, lint, fishskin, egg membranes, and foil. These were mainly popular folk remedies that required little expertise in its construction beyond trial-and-error. In 1848 the aural surgeon James Yearsley introduced his new technological marvel: an artificial tympanum made of cotton-wool with a silver wire stem; the device was later patented in 1856. Yearsley’s invention received modest attention until 1850, when the aural surgeon Joseph Toynbee presented his own artificial tympanum, made of vulcanized india rubber, at a meeting of the Provincial Medial Association, without any reference to Yearsley. In addition to debates about priority, Yearsley and Toynbee’s disagreements raised discussions on issues of expertise in the selection of materials: Yearsley selected his materials based upon his case studies, whereas Toynbee selected his from his anatomical investigations and theories of bone conduction. Both practitioners boasted their selection of materials made for a more superior device in restoring hearing loss, as diverse voices across the profession chimed into the debate. This paper examines the debate between Yearsley and Toynbee within the context of broader issues of legitimacy within medical and surgical practice as well as the contesting boundary lines between what constituted as “scientific practice” in the making of early non-electric air conduction devices.

Author: Axel Volmar


Abstract: Ever since the German physicist Hans Geiger (1882–1945) and his assistant, Walter Müller (1905–1979), presented their so called “counter tube” in 1928, the detection of radioactive rays is strongly associated with the sound of the device, the characteristic audible clicks which represent the number of ionization events. Although the Geiger-Müller-counter, or GM-counter, is among the best known instruments of modern physics, the meaning of auditory representation has rarely been addressed by historians of science. Since radioactivity is invisible to the naked eye, the history of measuring radioactivity in the first half of the 20th century represents a distinguished field for studying the interplay of the human senses, scientific instruments, and techniques of representation. It is interesting to note that earlier methods for detecting radioactivity did not feature an acoustic output, but followed, as Peter Galison (1997) has shown, the experimental traditions of image-making and logic devices. Given these existing traditions of visual and statistic argumentation in physics, this paper will examine why Geiger and Müller considered an auditory representation of radioactivity a useful option and how Geiger and his colleagues actually used the counter tube in their laboratory work. In doing so, I will place the GM-counter within a
wider history of auditory knowledge production. I will also turn to the history of radiation protection after World War II in order to show why GM-counters, and especially its sound, became a strong symbol in post-war popular culture.

Author: Daniel Volmar

Title: Trouble in “Science City”: Hanscom Field as a Literal Military-Industrial-Academic Complex, 1958–1962

Abstract: During the 1950s, the SAGE Air Defense Computer promoted a distinctive institutional relationship between science, industry, and government, with Laurence G. Hanscom Field, a small airstrip in suburban Boston, as its geographic center. Home to MIT’s Lincoln Laboratory, the MITRE Corporation, and several Air Force units, the “Hanscom Complex” had the potential to become an integral “Science City,” where electronics research and national strategy might have flourished together under unified direction. This paper will examine this military-industrial-academic community as it sought to expand its official mission and turn the SAGE experience into a repeatable pattern of innovation. In the aftermath of Sputnik, many experts believed that Soviet ICBMs would precipitate a catastrophic breakdown in national military-political decision-making. Hanscom’s boosters positioned themselves not only as experts in the digital electronics required to avert this “crisis in command,” but also as impartial critics of military organization itself. Air Force leaders perceived this latter demeanor as opposite to their own traditions and knowledge, and they exerted their powers of patronage to deflect the attention of civilian officials. Despite the early tension, the existence of the Hanscom lobby ultimately proved to be politically expedient. Its resources later swayed several key decisions in the Air Force’s favor, even as the Kennedy Administration changed the military-political landscape in Washington. In sum, the saga clearly exhibits the multiple valences of military-industrial-academic collaboration in a concentrated institutional setting: as a tool for technological innovation, as an expression of community ambitions, and as a platform for political bargaining.

Author: Emily Wakild

Title: Jaguar Traps, Monkey-Puzzles, and Parrot Quarantines: Accounting for the History of Women Field Scientists in Latin America

Abstract: Classic historical renderings of the natural field sciences in Latin America may bring to mind the observations of Alexander von Humboldt or the theories of Charles Darwin, both of whom spent years enchanted by the wilds of the region as young men. Yet, natural field scientists here have not only been men. Evidence culled from a range of locations, including academic publications, remote field station records, national field guides, and oral history interviews demonstrates that women have participated in and shaped the understandings of nature and conservation in Latin American countries for more than one hundred years. Though scarcely acknowledged in the historical record, these women had opportunities to study natural field sciences and made long and meaningful careers and achieved national prestige. The contributions of women scientists have been especially notable in the rise of Conservation Biology. Never common or a majority, the ubiquity of women’s participation in non-medical science complicates debates over women in science and historical renderings of the social context in Latin American nations. This paper draws upon archival and oral evidence and the author’s experiences working with biologists in field stations in Latin America to highlight the opportunities for conversations between historians and field scientists. Rather than looking primarily at national policy-makers to understand the rise of conservation, this paper asks how the development of natural field sciences influenced the creation of conservation areas and opened opportunities for women in science in wild and unexpected places.

Author: Scott Walter

Title: Poincaré's probabilistic approach to planetary physics and cosmology

Abstract: From the outset in 1880 of Henri Poincaré's career in science, he took up both practical and theoretical problems in astronomy that could be posed in terms of probabilities. The astronomical questions Poincaré posed in probabilistic terms ranged from the spatial distribution of asteroids, to the stability of the solar system, and the infinite extension of the universe. The details of Poincaré's employment of probability theory in the domains of planetary physics and cosmology reflect a growing confidence in statistical mechanics and, more generally, a recognition of the importance of probability theory to progress in theoretical physics.

Author: Iain Watts

Title: The Shadow of Napoleon: Understanding Science and the Newspapers, 1800-1815
Abstract: During the past two or three centuries one of the most likely places for most ordinary men and women to encounter written information about science was surely in the pages of a newspaper. Yet it is extraordinary how little we know about the relationship of the sciences to the daily press before the twentieth century. This talk takes a close look at their interaction in both Britain and France during the distinctive period of the Napoleonic wars, through a focus on the particularly “newsworthy” science of galvanism. Using the two contrasting cases of the Italian scientific visitor to London Giovanni Aldini, whose experiments later inspired Frankenstein, and the Englishman Humphry Davy (who shot to scientific fame during these years), I show how British newspapers appropriated science on their own terms, as part of their essential business: selling novelty. Aldini’s experiments were (unfortunately for him) mostly presented humorously, as grotesque horror. Davy too often found the press frustrating and impossible to control, but by and large the papers’ uniquely-detailed reports of his fashionable Royal Institution lectures assisted his own public self-fashioning as a chemist of “genius”. I then look at the French Moniteur, which frequently printed long articles on scientific subjects. As Napoleon’s official newspaper, the Moniteur was state-run rather than commercial, and accordingly treated science very differently. Its frequent use by British men of science as a source for new French experimental knowledge also highlights the error of consigning science and the newspapers to a simple pre-history of “popular science.”

Author: Albert Way

Title: New Grasses for the New South: Agrostology, Agriculture, and Environmental Transformation in the U.S. South

Abstract: This paper will explore the efforts of government agrostologists (grass experts) to find, import, and develop suitable pasture grasses for the American South. As farmers and agricultural leaders began to search for alternatives to cotton after the Civil War, they quickly realized that the lack of improved grasslands set the region apart from the rest of North America. Despite an abundance of native grasslands, observers such as Rupert Vance repeatedly lamented “the South is not naturally a grass country.” The U.S. Department of Agriculture and the Smithsonian picked up on the problem in the 1880s and embarked on a decades long effort to create a large international network of botanists, geneticists, explorers, seed distributors, and farmers to make the South a grass country. In this paper, I will present a small slice of the larger story, focusing most closely on the work of scientists at land grant experiment stations, and the environmental limitations they sought to overcome. I will also use this project as a lens through which to reflect on broader historiographical questions about the intersection of agricultural history, environmental history, and the history of science.

Author: Milena Wazeck

Title: What is “severe damage”? Facts and values in the US-Canada debates about lake acidification in the 1980s

Abstract: Damage to aquatic ecosystems caused by lake acidification was one of the best-documented effects of acid rain, and had been investigated in the US and Canada since the early 1970s. In 1987, the US National Acid Precipitation Assessment Program (NAPAP) concluded that only “a small fraction” (NAPAP 1987: I-8) of lakes in North America have been acidified. The Canadian acid rain program RMCC attacked this report to be “misleading, flawed, and incomplete” and asserted that not “some”, but “numerous” lakes have been acidified (RMCC 1987: 5). Why did scientists in the US and Canada come to different conclusions about the extent of lake acidification in North America? I will discuss several reasons for this dispute, including disagreements about the appropriate way of measuring lake acidity (pH value versus acid neutralizing capacity, ANC), and about the appropriate reference value for pH or ANC. I show that the disagreement about reference values raised complex questions of what biological damages are observed at certain pH and ANC levels. My talk points out that US and Canadian scientists did not only disagree about at which pH or ANC values noticeable or severe damages occur, but also about what a “noticeable” or “severe” damage is. I argue that the debate over lake acidification involved deep disagreements about values that were hardly made explicit, but that substantially influenced the creation of facts about the extent of lake acidification.

Author: Andreas Weber

Title: A Master of Paperwork: C.G.C. Reinwardt (1773-1854), Natural History and the Governance of the Dutch Empire in the East

Abstract: The vast paperwork of the naturalist, chemist and administrator C.G.C. Reinwardt which is now scattered across archives in the Netherlands and Indonesia allows a fresh view of practices of natural historical and bureaucratic writing in the
early nineteenth century Dutch Empire. By zooming in on Reinwardt’s seven-year stay in the Malay Archipelago, this paper shows that writing about colonial flora and fauna was never a straightforward endeavor. In particular on his journeys through the hinterland of the colonial entrepôt Batavia (1819) and the neighboring Moluccas (1820-21), the steady supply of good writing paper and ink required organizational skills and creativity. Unfavorable environmental conditions and vermin further complicated conservation of used paper. Next to issues of local provision and conservation, Reinwardt was continuously forced to meander between the bureaucratic fantasies of his superiors in Batavia and the expectations of a growing reading public at home. While newspapers and friends in the Netherlands hoped to receive regular summaries of his work in the field to publish in print, the colonial government overwhelmed the traveler with requests to compile reports on the efficient usage of the colony’s human and natural resources. Taken together this paper makes two interrelated points: one the one hand it argues that in the case of the Dutch Empire natural history and bureaucracy were closely intertwined endeavors. On the other hand it claims that proper management of paper and ink formed an essential part of every productive natural historical and bureaucratic inquiry.

Author: Olivia Weisser

Title: Making Observations: Patients and the Medical Encounter in Early Modern England

Abstract: This paper examines a particular site of knowledge production in seventeenth-century England: the sickroom. Pioneering scholarship has recovered the ways that patients’ words, demands, and behaviors could be crucial to structuring early modern medical practice. Seventeenth-century medical casebooks offer abundant evidence to support this narrative. And yet, these sources provide a limited view of the actual words patients uttered in the sickroom, as well as the significant ways that prevailing beliefs and norms shaped patients’ perceptions — and therefore medical practice more broadly. My paper argues that a close analysis of English healers’ varied writing practices, particularly the content and form of seventeenth-century casebooks, offers insights into the social dynamics of the sickroom. Some cases, for instance, were compilations of terse notes that practitioners did not necessarily want to preserve; others were clearly intended for publication. While I do not suggest that we should codify casebooks into rigid typologies, my paper shows how viewing casebooks as varied forms of writing helps to recover a fuller understanding of early modern medical practice. The absences and silences are particularly telling, as we can begin to read the negative spaces in healers’ writing that formed the background to aspects of the medical encounter that practitioners were eager to highlight. The resulting analysis is significant for recovering the interactions that structured early modern medical care, including the words and behaviors of patients that have been written out of the historical record.

Author: Alex Wellerstein

Title: "There is no mystery about producing a 50 megaton bomb": Very High-Yield Nuclear Weapons and the Limited Test Ban Treaty

Abstract: After a nearly three-year test moratorium, the Soviet Union resumed nuclear testing with a bang. Over the last three months of 1961, they detonated nearly 60 nuclear devices, at least of 11 of which were in the megaton or multi-megaton range, and one of which, the infamous "Tsar Bomba," was the largest nuclear weapon of all time. This bomb was air-deliverable with a maximum yield of 100 megatons, nearly seven times the largest nuclear weapon tested by the United States, and nearly seven thousand times more powerful than the bomb used on Hiroshima. Within the Kennedy administration, this resumption of testing -- much less testing of such unprecedentedly high yields -- motivated conflicting desires both to limit atmospheric nuclear testing as well as to conduct their own high-yield atmospheric test series. In part, the question became whether the Soviet example was one to criticize as harshly as possible, or one to emulate in the name of national security. This paper will explore the paradoxical role that high-yield nuclear weapons had in spurring political and scientific enthusiasm for and against an atmospheric test ban treaty, as the United States contemplated its own "very high yield" nuclear weapons program.

Author: Christina Wessely

Title: The Aquarium and the Formation of Modern Ecology

Abstract: The paper argues that marine biology around 1900 was an important arena for the formation of modern ecology, and that it was foremost its material culture that helped shaping notions of environment, milieu and Umwelt. When in 1980 the ethologist and nobel laureate Konrad Lorenz was asked to name what had most fundamentally influenced his work, he stated, that "virtually pushed me to do ecology" and "inspired me to develop a perspective on the whole, on ecosystems." Initially regarding the aquarium just as a tank for keeping fish for his experiments -- as a neutral
container without any influence on his research – it soon became an active agent in Lorenz’ work. Struggling to establish environments for marine animals that fully resembled oceanic milieux in the aquarium, he soon realized that it was precisely the narrowness of the glass box that forced him to think about the dimensions of environment in general, its qualities and boundaries, before he could even start to work with fish. The paper will show that the fact that Lorenz conceives the aquarium as the material inspiration for ecological theory formation is not due to biographic coincidences. Rather, it is rooted in a tradition that goes back to the turn of the twentieth century and established the aquarium as a structural point of reference for ecological thinking.

Author: Peter Westwick

Title: Serving the State and Science: The NAS and the Vietnam Era

Abstract: The U.S. National Academy of Sciences is a private organization with a public function, to advise the federal government when called upon. It also aims to advance the cause of American and international science. What does the Academy do when these two goals—service to the nation, and service to science—do not align? And how much influence has the Academy wielded over American policy? This paper will look at the Academy’s response to the Vietnam War, when scientists struggled to reconcile science and politics.

Author: Megan Williams

Title: Armament of Embassy: Paper as a Tool of Governance in Sixteenth-Century Habsburg Foreign Policy

Abstract: This paper examines the mechanisms by which the sixteenth-century Austrian Habsburg court chancellery, and the diplomats with whom chancellery secretaries corresponded, procured and employed steady supplies of affordable, quality paper and writing supplies. Much of the existing research on paper has focused on its production, which accelerated across Europe in the fifteenth and early sixteenth centuries; far less is known about how governing institutions in that period procured and wielded the paper they wielded as a key tool of governance, whether domestically or, as this contribution emphasizes, on the foreign stage. Paper offered these nascent bureaucracies an effective method of organizing and managing political knowledge. In particular, this contribution suggests that chancelleries' and diplomats' access to cheap paper was prerequisite to shifts in early modern diplomatic practice -- thereby altering the ways in which chancelleries obtained, controlled, and deployed strategic political information in their foreign policymaking processes.

Author: Benjamin Wilson

Title: The Controllers: Nuclear Arms Control, Community, and Conflict in the 1960s

Abstract: In the years around 1960, a wide range of expert observers came to perceive the risk of nuclear war, and the accelerating nuclear arms race, as a central crisis of the Cold War. Nuclear weapons seemed to present a problem of extraordinary scientific, political, legal, and economic complexity. For many officials, the solution to the problem of nuclear weapons lay in the newly emerging field of nuclear arms control, which cohered as an independent field of study and a formal government enterprise in the early 1960s. This paper examines the rise of arms control as an interdisciplinary academic field bridging the physical and social sciences. In two particularly important venues—the 1960 Summer Study on Arms Control sponsored by the American Academy of Arts and Sciences, and the Joint Harvard-MIT Faculty Seminar on Arms Control—a community of experts formed around a diverse set of methods and questions, from the “technical” requirements of treaty verification to codes of international law. Traffic between the government and the early arms control community was remarkably heavy; many academic arms controllers would serve in highly placed government posts, from the newly formed Arms Control and Disarmament Agency to the White House. Yet the untroubled alliance between arms control and government prerogatives did not outlive the 1960s. The Johnson and Nixon administrations’ pursuit of controversial programs (especially anti-ballistic missiles and offensive missiles equipped with multiple warheads) initiated a rift between the arms control community and the government that would only deepen in the 1970s.

Author: Anna Winterbottom

Title: Medical Cosmopolitanism and Design in Kandyan-Period Sri Lanka

Abstract: Sri Lankan medicine has normally described as a branch of Ayurveda and has received little independent attention from medical historians. However, examining the range of techniques and materia medica employed in the central Kandyan
kingdom reveals a far more cosmopolitan reality. During what is commonly known as the Kandyan period (c. 1472-1859), the central kingdom received medical influences not only from the South Indian rulers of the kingdom, but also from their Muslim physicians; from the bhikkus who arrived from Southeast Asia to participate in state-sponsored renewals of Buddhist learning; and from traders from China and Southeast Asia. The Dutch, Portuguese, and finally the English who established colonial settlements around the edges of the island and traders and later slaves who arrived from East Africa also influenced the practice of medicine in the kingdom. Despite this cosmopolitanism in terms of the supply of medicines and medical techniques, the ways in which medicines were packaged were highly specific to Sri Lanka and the designs demonstrate a high degree of continuity throughout the period. Medical manuscripts also demonstrate the influence of foreign medical conventions, including the use of anatomical diagrams and are similarly highly specialized in terms of their composition; including elements such as secret languages intended to safeguard their contents. I will use the example of Sri Lanka to discuss the wider issues of Indian Ocean cosmopolitanism, cultural boundaries, and the role of material culture in medicine.

Author: Aaron Wirth

Title: A Medical Turf War: Rural Physicians and the Holy See in Post-Unification Italy

Abstract: In last few decades of the nineteenth century significant breakthroughs in science and medicine had greatly increased the prestige of many Italian physicians on an international level. Yet, in rural Italy, the municipal doctors—employed by the communal governments—still found it difficult to find recognition among the deeply religious, superstitious population. Their malnourished patients, who lived in abject poverty, were usually suspicious or indifferent of their status and scientific training. Positivists argued that these state-sponsored doctors were best suited to care for the nation’s poverty-stricken rural dwellers, those physically inferior deviants who were prone to insanity, alcoholism, and sickness. All the while, the doctors were in constant competition with the local clergy. Vatican-sponsored charity houses (opere pie) and midwives, and charlatans; many of whom possessed an elaborate armamentarium that rivaled the poorly-funded physicians’ equipment. The opere pie, in particular, poisoned the atmosphere between the medical profession and the people. Glaring contradictions existed between the terms of the medieval benefactions that had founded the hospitals and the changing medical requirements of a modern state. As a political compromise with the Vatican, nuns acted as nurses on the wards but formed part of a very different disciplinary structure, lacked formal medical training, and saw their task in religious rather than scientific terms. The situation resulted in a complex relationship between science and faith that was often detrimental to the health of Italian citizens.

Author: Rebecca Wolf

Title: The Sound of Silver and Gold: 19th Century Experiments with Materials and Acoustics

Abstract: Around 1800 a variety of acoustical experiments for the improvement of musical instruments took place. For example, the work of the inventor and performer of acoustic phenomena Ernst F. F. Chladni reflects the desire to legitimate musical theories through the affiliation in the science of acoustics. He wrote many important articles about the detection of sound, the nature of acoustic waves, and about theatre acoustics. Moreover, Chladni’s writings motivated further discussions about the relevance of material in relation to sound quality. In this context we can focus on two scientists, who collaborated in Munich, Germany, to improve the flute. The first, Karl E. von Schäfhaeutl, published extensively on the role of materials while Theobald Boehm designed flutes combining new materials and forms, which became standard among musicians. They were involved in a discussion on the function of materials and their significance in the generation of tone. Boehm’s aims were an equality of tones and a brilliant sound. Furthermore, silver became his favorite material, and often he used golden mouthpieces for his flutes. In addition, Boehm’s instruments became a point of controversy for contemporary audiences. Using such cases as a starting point, this paper will analyze the discourse of materialism and idealism with focus on music and instruments during the 19th century.

Author: Audra Wolfe

Title: Textbook Diplomacy: The Biological Sciences Curriculum Study Abroad

Abstract: On May 15, 1961, James Dickson, an advisor to the Biological Sciences Curriculum Study (BSCS), a post-Sputnik U.S. textbook reform program, suggested that his colleagues approach the Central Intelligence Agency (CIA) for possible support of the BSCS’s overseas activities. Four days later, the BSCS learned that it had received "special" grants from the National Science Foundation, the Rockefeller Foundation, and The Asia Foundation (a CIA pass-through organization) to support its work with biology educators in Latin America and Asia. Thus began the BSCS’s ten-year foray into textbook diplomacy—an episode that can only be understood in the larger context of Cold War scientific exchange. The foreign offices that the BSCS established throughout Latin America and along the Chinese perimeter were backed with support from the
U.S. foreign policy establishment. To be clear: these BSCS offices were not "cover" for nefarious clandestine activities; the BSCS's patrons really were bankrolling textbook reform. This paper focuses on the BSCS's efforts in Asia, where the financial ties to the U.S. intelligence community are most clear, to explore how these efforts fit into a larger strategy of scientific diplomacy. Using documents from the U.S. National Archives, the Hoover Institution Archives, and the American Philosophical Society, the paper traces how both the BSCS's organizers and Asia Foundation program officers hoped to use biology education to build stronger ties between foreign elites and the United States.

**Author:** Charles Wolfe

**Title:** Materialism and Epigenesis in Diderot’s biological project

**Abstract:** Diderot’s natural philosophy, which emerges some decades prior to the appearance of the term ‘biology’ in the 1790s, is profoundly ‘biologicistic’. Both the metaphysics of vital matter in D’Alembert’s Dream and the more empirical concern with physiology in his unpublished Elements of Physiology display a fascination with the uniqueness of organisms. This ‘biologicism’ presents Diderot’s interpreter with some difficulties, notably regarding his materialism, for contemporary forms of materialism reject emergence, vitalism, teleology or other appeals to biological irreducibility. Here I examine a little-known aspect of Diderot’s proto-biological project: his association of epigenesis with Spinozism in the short article “Spinosiste.” Why defend a particular developmental theory in an entry on Spinoza (who was barely concerned with the specific properties of organisms)? My response also addresses the relation of Diderot’s biological project to biology as a science that appeared after his death. Indeed, Diderot’s ‘epigenetic Spinozism’ stands conceptually outside the history of biology. But it is a significant articulation of the biological theory of epigenesis with philosophical materialism.

**Author:** Rebecca Woods

**Title:** (Re)Production

**Abstract:** Questions of biological reproduction and the production of capital offer one of the more successful examples of the integration of the histories of science and histories of capitalism. Scholars from the history of science and from STS have engaged the ways in which the extension of capital finance and industry to forms of life have resulted in new forms of capital, including patented genes, species and cell lines, sometimes placing these formations under the rubric of “biocapital.” But the intersections of living organisms and capital have longer, more complexly-woven histories in which the generation or production of one often serves as metaphor and/or the means for the re/production of the other. Drawing on examples from the world of nineteenth-century livestock breeding, this comment will interrogate the historiographical treatment of such metaphorical and material nodes of capital and the biological.

**Author:** Aaron Wright

**Title:** Everything From Nothing: John Archibald Wheeler’s Metaphysics of the Vacuum

**Abstract:** John Archibald Wheeler (1911–2008) was a consummate American scientist. Trained at Johns Hopkins, Wheeler was a nuclear physicist who contributed to the American atomic bomb and the post-war hydrogen bomb projects. He spent his career at Princeton, where, after the war, he transitioned to studying the physics of Einstein’s theory of gravity—General Relativity. This paper explicates Wheeler’s metaphysics as it shifted during his years as a “relativist” using published and unpublished sources. I argue that Wheeler’s thought was characterized by a philosophical drive toward the underlying roots and causes of things, characteristic of the philosophical tradition of Anglophone analysis. Wheeler’s thought was also characterized by a delight in paradox, and a desire to progress through paradoxical formulations such as “mass without mass” and “charge without charge.” In 1953 Wheeler first proposed to consider the “view that only fields of zero rest mass should be regarded as fundamental”: the electromagnetic field, the gravitational field, and the neutrino field. In 1955 Wheeler and his student Charles Misner discovered that in fact they could capture a complete picture of classical physics with only one zero rest mass field; the gravitational field. Here he was moving toward a view that the vacuum is fundamental, which he would express by 1956. This was the beginning of his thoughts that empty space may not be simply the arena for physics, but may actually constitute matter. Perhaps everything was really nothing.

**Author:** Ben Wurgaft

**Title:** Muscles without Bodies: the Philosophy of Biology and the Strange History of In Vitro Meat

**Abstract:** Over the past ten years tissue-engineering laboratories in the Netherlands, Scandinavia, Japan and the United
States have labored to produce animal protein through in-vitro processes. Their goal, which journalists have labeled “vat meat,” is a viable substitute to meat which would be far less environmentally damaging (and more humane) than conventional animal agriculture. Their ambition is nothing less than to transform the future of food security and alleviate malnutrition on an increasingly crowded globe. This paper begins by isolating the emerging philosophical and ethical questions “vat meat” has raised, questions that underscore our anxieties about crossing the line between “organism” and “artifact.” It then demonstrates that many of these questions were raised by mid-twentieth century thinkers who were deeply interested in metabolism. These include Martin Heidegger’s student Hans Jonas and the biologist Ludwig von Bertalanffy, with whom Jonas maintained a correspondence and who is remembered primarily as a founder of Systems Theory. Major themes in their works include the isolation of “life” and “metabolism” as meaningful processes and the question of how those processes manifest in cells, organs, organisms and “systems,” broadly understood. This paper proposes that we return to their efforts to understand metabolism as we sort through our own conflicts over the categories of “organism” and “artifact,” conflicts that shadow contemporary conversations about emerging biotechnologies. Finally, it suggests we attend to the relationship between the philosophy of biology and the perceived pace of biological research: does “vat meat,” for example, demand new ideas, or returns to old ones?

Author: Yibao Xu

Title: Serve the People: CPM and PERT in China during the Cultural Revolution

Abstract: The Critical Path Method (CPM) is an algorithm for finding the most efficient way of scheduling a set of project activities. It is used in conjunction with The Program Evaluation and Review Technique (PERT), a statistical tool in analyzing the activities involved in completing a given project. Both were developed in the 1950s in the United States. In the early 1960s, the most renowned mathematician in China, Hua Luogeng (or Hua Lo-keng, 1910-1985), saw their usefulness in national economy and production, and advocated them in China. Later during the Cultural Revolution, despite his caliber as a first-rate research mathematician he taught them to the peasants, factory workers, and soldiers, and led his students, applying them in a number of projects across the country. His actions were applauded by the top leaders of the Chinese Communist Party. Accordingly, the CPM and PERT are the most popular mathematics taught and applied in mainland China during the Cultural Revolution. This presentation will examine preliminarily the backgrounds of the introduction of the CPM and PERT, and discuss the ways in which they are popularized and utilized through the work done by Hua and his students.

Author: Alper Yalcinkaya

Title: Debating Science and Identity In the 19th Century Ottoman Empire

Abstract: The 19th century Ottoman debate on the meaning and boundaries of modern science was at the same time a debate on what the Ottoman public itself was. Arguments on science often involved explicit or implicit arguments on the boundaries of “true Ottomanness.” In this paper I focus on the arguments of Muslim Turkish participants and outline two dimensions of the linkages between science and identity in the Ottoman debate. In the mid-19th century political elites strived to forge a new “Ottoman” identity that would transcend religious and ethnic affiliations, and save this diverse society from disintegration. In this context science was represented by the elites as a realm in which this identity could flourish and all communities of the Empire could co-exist. Yet as many Ottoman Muslims perceived the political changes as a rise in the status of non-Muslims at their expense, an alternative discourse emerged that emphasized the Islamic character of the Empire, portrayed science as an area within which Muslims and non-Muslims were in competition, and praised Muslims’ contributions to science. However, “Muslims’ contributions to science” also failed to serve as a unifying theme, as the European works on this topic that Ottoman intellectuals also referred to portrayed most Muslim scientists as Arabs – a portrayal with which many Ottoman Turkish intellectuals felt uneasy, giving rise to an emphasis on “Turkish contributions.” Science thus remained a topic that could not be discussed without a reference to identity.

Author: Elizabeth Yale

Title: Upcycling Science: Collecting, Editing, and Publishing Scientific Papers in the Early 18th Century Royal Society

Abstract: In the process of creating accounts of the natural world, seventeenth-century British scientists assembled massive amounts of written material, including commonplace books, correspondence, notes, and drafts. They prepared some of these writings for the press while they lived, but often, a great deal remained unpublished at their deaths. Much of this material was, in fact, never intended to be published. Yet, at the turn of the eighteenth century, as a generation of scientists that included some of the early members of the Royal Society passed away, a few of their younger contemporaries began collecting, editing, publishing, and archiving their writings. This paper explores the uses that collectors and editors, including
Hans Sloane, William Derham, and Richard Waller made of their dead contemporaries’ papers, focusing in particular on the writings of Robert Hooke and John Ray. I argue that editors and collectors “upcycled” these papers, presenting them at Royal Society meetings and transforming rough notes and correspondence into printed treatises and contributions in the Philosophical Transactions. This activity was animated by twin impulses to celebrate the dead and to make their writings useful to the scientific public. Editors and collectors took fragments that they felt could be an aid to ongoing scientific investigations, and repurposed them for a new cultural context, investing them with meanings shaped by eighteenth-century conceptions of science. In the process, they revealed much about their understanding of the relationship between science and its history, and laid the foundations for an understanding of seventeenth-century science that remains influential.

Author: Chen-Pang Yeang

Title: The Resilience of an Inconsistent Model: Kirchhoff’s Diffraction Theory of Light

Abstract: The development of wave optics in the 19th century initiated a number of problems, some well-known to historians, such as the nature and behavior of the carrier medium (ether). Most work, however, focused on elaborating such technical issues as the forms and solutions of the scalar wave equation to generate a consistent account of diffraction. In 1882, Gustav Kirchhoff used Hermann Helmholtz’s form of the scalar wave equation to solve light diffraction by a small aperture. In doing so he specified boundary conditions for both the light intensity and its gradient. Ten years later, Henri Poincaré demonstrated that Kirchhoff’s conditions were mutually inconsistent. Arnold Sommerfeld then revised Kirchhoff’s assumptions by specifying either the intensity or its gradient, but not both. Kirchhoff’s theory did not however vanish. Rather, it received increasing attention among physicists and engineers and was treated as a useful approximation for its good fit with experimental data. Recently, philosophers Juha Saatsi and Brian Vickers have employed Kirchhoff’s case to challenge forms of realism that attribute the success of a theory to its truth value. Our study aims to examine the historical conditions that enabled the resilience of Kirchhoff’s model. Was the solution’s good fit with data the only factor explaining its continued use? Or were other factors at work, such as changes in technical practice as optical phenomena were increasingly embedded in devices? What moreover was meant by “approximation” in the absence of any such demonstration?

Author: Jacy L Young

Title: “An ideal laboratory for studying social phenomena”: Researching Social Relations in Children’s Summer Camps

Abstract: During and immediately after World War II psychologists were increasingly preoccupied with how they might play a role in bringing about peace. In an effort to better understand both how democratic values might be instilled in individuals and how initially antagonistic groups might learn to cooperate, these psychologists took their science outside of the laboratory and into the field. For psychologists seeking naturalistic settings in which to conduct research on social relations, children’s camps were particularly appealing. As isolated communities quite literally situated in nature these camps served as microcosms of real, unfettered social relations. In this paper I look at research conducted by Canadian psychologist Mary Northway, as well as research by husband and wife psychologists Muzafer and Carolyn Wood Sherif, and argue that the move from the laboratory into the field was an attempt to lend this research greater validity. Investigating social relations in the camp context allowed psychologists to, at the very least, strive toward the authenticity of real world social interactions. Yet, at the heart of this research was an inherent contradiction: while appealing to the apparent naturalness of psychological phenomena studied in camps these psychologists also strove to transform this setting into an extension of the laboratory ideal. Inasmuch as naturalness seemed to ensure the applicability of findings to the larger world, total control of the environment promised to reveal causal relations. Both were necessary in constructing an understanding of social relations that could serve to better the world.

Author: Nasser Zakariya

Title: The Geometry of Fixed and Unfixed Stars: Shapley and Lemaître in the 1920s

Abstract: In the “Great Debate” of 1920, astronomers Harlow Shapley and Heber Curtis argued over the structure of the universe, appealing to clashing interpretations of gaseous nebulae and positions of visible stars. Over the coming decade, the Belgian priest and mathematical-physicist Georges Lemaître travelled from one Cambridge to another, puzzling out his own understanding of that structure. Lemaître worked with A.S. Eddington in England and with the newly relocated Shapley at the Harvard College Observatory, coming into contact with observational astronomers such as Vesto Slipher and Edwin Hubble. Before the decade was out, Lemaître formulated a general relativistic interpretation that saw galaxies flying apart, rendering the terms of the Great Debate obsolete. Returning to this history, I want to examine one aspect of the nature the
shift from Shapley to Lemaître, of whether the differences in their work indicate differences in the degree of their dependency on the position of stars, and whether and how that dependency was challenged. The adoption of Einstein's cosmological considerations gave new reasons for relying on massive stellar systems in attempting to determine the overall geometry of the universe, but the singular reliance on stars and nebulae in determining the structure of the universe far predated his theories. How significant then were Einstein's surveying metaphors and how distinct were they from those animating efforts of preceding generations? Conversely, how far were Lemaître’s interpretations made more plausible by their commitment to a convention that had also held when the stars were still understood as fixed?

**Author:** Jeffrey Zalar

**Title:** The Popularization of Science in Catholic Germany, 1871-1918

**Abstract:** Recent historical scholarship argues that although they cherished their belief in divine authorship of life, and while they continued to assert nature’s providential aim, by the early twentieth century, German Catholics were in broad agreement with the normative concept and epistemic validity of scientific knowledge. And yet, we still know so little about the process of approximation by which Catholics moved intellectually from a vita religiosa of largely metaphysical assumptions about the phenomenal world in the early modern period to a vita scientia of predominantly materialist naturalism in classical modernity. My paper will discuss aspects and tendencies of this process as they unfolded in the German Empire (1871-1918) by analyzing the popular scientific books Catholics read and the positions believers took up in relation to them. Catholics were avid readers of such books, which they encountered not only in schools but in their confessional book clubs and vocational reading rooms. As they embraced market consumerism, Catholics also valued scientific books as Christmas and Name Day gifts, which they honored with conspicuous placement in family living rooms. The philosophical-theological rhetoric governing the reception of these books, transmitted via confessional newspapers, popular scientific readers held in Catholic libraries, and pastoral journals, allows us to define a uniquely Catholic method of disseminating science (Wissenschaftspopularisierung). The particular value of this paper, then, is in demonstrating how the conceptual gap between early modern and modern appropriations of nature narrowed among a population usually declared to be inattentive to scientific learning.

**Author:** Isabel Zilhão

**Title:** Science for Children Voiced by a Portuguese Daily Newspaper (1924-1933)

**Abstract:** The libertarian side of science was early acknowledged by pedagogues. Conceptually speaking science should lead us to a more even society because of the liberty it offered to ask questions and to freely discuss them. Portuguese republicans understood it and endorsed Progressive education in order to push modernity forward in a country dominated by low levels of literacy inherited from the monarchy. Non-religious co-education for all was promptly legislated soon after the republican revolution (1910) while the republican elite engaged in an educational movement outside the official framework. This movement comprised lectures in popular universities, as well as popularization articles published by the press. After WWI, Republicans put into practice a new round of education reforms. Notícias Miudinho (News for youngsters), printed at the bottom of pages of the nationwide daily newspaper Diário de Notícias (Daily News) and covering a wide variety of topics, stemmed from that movement. Based on a comprehensive survey of articles popularizing science, technology and health topics for children printed in a Portuguese daily newspaper from 1924 to 1933, I intend to show how they tuned with the ongoing Portuguese political agenda for modernizing the country. Moreover, I intend to show how they implicitly passed on moral codes for constructing a new bourgeoisie.