

# HSS Abstracts

**Mazi Allen**, Saint Mary's College of California

*Attitude musulman maghrébine devant la folie and Le phénomène de l'agitation en milieu psychiatrique: An Extended Critique of Psychiatry in the West.*

Frantz Fanon (1925-1961), originally from Martinique, was a psychiatrist who became involved with the Algerian Independence movement through his clinical practice in Algeria (and later Tunisia.) Despite his involvement in the movement, he nonetheless maintained an active clinical practice until shortly before his death. This paper will examine two of his articles, both published in medical journals during the late 1950s: "Attitude musulman maghrébine devant la folie" (1956) and "Le phénomène de l'agitation en milieu psychiatrique" (1957). Drawing upon his experience in Algeria, the first article consisted of a comparative study of psychiatric treatment in traditional North African societies and the West. The second was a clinically based study on agitation in a psychiatric setting. Read together, I will argue, both of these papers constitute an extended critique of the often inhumane practices of Western psychiatry during the 1950s. Although Fanon is now primarily known as a "postcolonial" literary figure, hopefully this paper will shed more light on his role as a clinical psychiatrist practicing during the decolonization era.

**Warren Allmon**, Cornell University

*Of Babies and Bathwater: Osborn, Gould, the Synthesis and Paleontology*

Much of the "internalist" evolutionary mechanisms advocated by Henry Fairfield Osborn in the first three decades of the twentieth century was discarded after his death with the triumph of the Modern Synthesis in the 1940s. Stephen Jay Gould repeatedly criticized what he called the "hardening" of the Synthesis around natural selection to the exclusion of more internal factors. Gould never defended Osborn explicitly, however, largely because he despised Osborn's racism and support for eugenics. Yet Osborn's and Gould's views of the evolutionary process have much in common. They were both paleontologists who focused on structural regularities in the ontogeny and phylogeny of taxa as biasing factors in determining evolutionary direction, and both were highly skeptical of the hegemony of selection. As was true of Osborn, many evolutionary biologists discount much of Gould's work, their "internalist" perspectives have much in common with the patterns being detected by modern evo-devo and are not as easily rejected as they might seem.

**Thomas Anderson**, Binghamton University

*Globalizing the Strange: The Science of 19th Century Madagascar*

Madagascar's unique ecosystem placed it in the middle of some of the most important scientific debates of the nineteenth century, from Darwinism and race theory to biogeography and human origins. The island's peculiar faun and flora captivated the interest of naturalists, missionaries, and explorers who referenced their findings to a global experience and knowledge that prized universality. This meant that the debate over Madagascar concentrated not just in explaining its peculiar nature, but also in a way that made sense to global theories and contemporary notions. This paper explores how Madagascar was globalized during the nineteenth by exploring the interplay between the discovery of strange species and how they were placed into a global framework. In the end, peculiar features were often minimized to stress the commonality of Madagascar's fauna and flora with the world

**Katharine Anderson**, York University

*The scientist and the reef: coral and the nature of ocean life*

This paper examines research into coral organisms and coral formations at the end of the nineteenth century and the beginning of the twentieth century by British and American scientists: J. Stanley Gardiner, C.M. Yonge, and T. Wayland Vaughan. It considers how attention to aesthetic concerns can help us understand the shifts in the history of the marine sciences at this time. Many of the successes of this period – in both biological and physical marine sciences – were associated with quantitative methods and a break with the style and reputation of natural history. Aesthetics seem accordingly to have little place in the modern scientific literature: its concerns are a part of ordinary observation, in distinction to scientific observation. Yet this intellectual framework – encompassing nature as spectacle, the repulsive or beautiful qualities of the natural subject – had a particularly strong history in the study of coral, and I will argue that it continued to be significant for scientists. Amongst other things, it contributed to claims about the necessarily interdisciplinary style of marine science, and to research methods which sought to relate organism and environment.

**Rachel Ankeny**, University of Adelaide

*Cases as 'Fact Carriers' in Contemporary Medicine*

Medical cases, whether individual case reports, studies, or even case series, are thought to be unscientific, anecdotal, and clearly inferior to other forms of evidence, due to their focus on individual patients. Cases have traditionally been held in disrepute, a trend which is associated with the historical shift toward more scientific, reductionistic explanations of disease. Despite these trends, the case still is exceedingly popular: it is estimated that 40,000 new case report publications are entered into Medline each year, with the core 120 clinical journals on average having 13.5% of their references devoted to case reports. This paper presents a series of examples of medical cases from the mid-20th century to the present day in order to develop a typology of cases with particular focus on how cases bring together what might otherwise be viewed as discrete or isolated facts, and thus how they become a form of evidence. It traces the evolution of each of these cases and the disposition of the facts that they carry in order to explore how cases serve "fact carriers." It also assesses what may be lost (or gained) in the process of the constitutive facts being grouped together in a case, as well as when they travel into new domains beyond that of the original, index case.

**Melinda Baldwin**, Princeton University

*Nature's contributors and the changing of the scientific guard, 1869-1900*

Although *Nature* is arguably the world's leading scientific publication, little historical work has been done on the journal's history or how it ascended to a position of such importance within the scientific community. This paper argues that *Nature's* establishment as a central institution of British science in the late nineteenth century was linked to the rise of a new generation of British men of science. *Nature's* editor, Norman Lockyer, who founded the journal in 1869, initially advertised the publication as a popular journal aimed largely at lay readers. As a result, men such as John Tyndall, Herbert Spencer, Alfred Russel Wallace and William Thomson did not see *Nature* as a desirable place to publicize their original research, preferring more established venues such as the *Philosophical Transactions* or the annual meeting of the British Association for the Advancement of Science. In contrast, younger men like George J. Romanes, E. Ray Lankester, and John Perry adopted *Nature* as a forum where they could quickly make their important findings public and debate the most important scientific questions of the day before a knowledgeable readership. The contributions of this younger generation established *Nature* as essential reading for British men of science in the final decades of the nineteenth century.

**Ellen Bales**, University of California, Berkeley

*Nuclear Images, Nuclear Imaginaries, Nuclear Fears: Cultural History Beyond "The Public"*

Since its publication in 1988, *Nuclear Fear*, Weart's cultural history of images, has suggested to historians of science that nuclear imagery should neither be read merely as an indicator of what "the public" knew (and when they knew it) nor as a simple measure of relative degrees of nuclear enthusiasm. Instead the multidirectional mobilization of powerful and allusive imagery had both intended and unintended consequences in the realms of public policy, politics, safety, and personal and collective risk decisions. Reading through the lens of Weart's work, this paper will explore three 20th-century American "nuclear imaginaries"—systems of images mobilized around a particular nuclear question—each related to some aspect of the production of nuclear weapons or to potentially hazardous radiation exposures. Generated by government agencies, the media, business concerns, and interested members of the public, these nuclear imaginaries drew not only on traditional nuclear imagery but embedded it in metaphorical spaces that had their own constellation of associations, e.g., "the natural," "the Old West," "the home." These new combinations of imagery suggest a direction in which to develop an extension of Weart's ideas; that is, towards an understanding of the strong and unforeseen responses elicited by potent nuclear images that were themselves located within an imaginary space with its own historical and metaphorical undertow.

**Grant Barkley**, Kent State University

*Joseph C. Arthur [1850-1942]: First Proof Of Bacteria As The Cause Of Plant Disease.*

In 1884 Joseph C. Arthur, during his tenure as a Station Botanist at the NY Agricultural Experiment Station, was the first experimentalist to offer definitive proof of a bacterium as the cause of a specific plant disease. Early in 1884, Arthur began work on orchard diseases including "pear blight." Working from a suggestion made by T.J. Burrill in 1883 that a species of *Micrococcus*, specified as [*M. amylovorus*] was associated with pear blight, Arthur produced a series of experiments which took Burrill's suggestion to conclusive proof. Arthur, in his carefully kept notebooks, recorded a series of inoculations made to trees of Flemish Beauty pear. Arthur's Experiment 84 was an inoculation made on 26 July 1884 from an infusion of blight of apple secured from Atwood's nurseries. The following year, Arthur used a "very small fragment of wood" from his field Experiment 84 to produce inoculum. Arthur, using the last dilution in a series of six serial transfers with sterilized corn meal, was successful in producing infection in a ripe Bartlett pear. He further demonstrated, using filtration, that the filtrate was not the cause of the disease. This work, published in the *Botanical Gazette*, Sept.- Oct. 1885, was acknowledged as the first definitive proof that bacteria could be a source of plant diseases. In 1887, Arthur published his methodology, which became established proof that suspected bacterium was the cause of a specific plant disease. His criteria, used in 1885, was produced simultaneously with, but independent from, the publication of Koch's Postulates.

**Megan Barnhart**, University of Minnesota

*Turning "Ordinary Housewives" into "Opinion Makers": The Scientists' Movement, the NCAI, and the Nascent Public*

In the aftermath of World War II, feeling it their duty to educate the American people about atomic energy, groups of scientists began to form at laboratories across the nation, eventually coalescing into the Federation of American Scientists (FAS). The FAS developed the National Committee on Atomic Information (NCAI) as the primary mechanism to promote its educational agenda. The FAS wanted to work with the NCAI to educate the American people and create "opinion makers" out of "ordinary housewives." When the American public began to respond to their call for action, however, FAS scientists and their colleagues leading the NCAI did not know quite how to respond. Letters poured into the NCAI from individuals across the country who were concerned about the future of their world and who wanted to know how they could help to further the scientists' cause. For a time, this nascent public was ready and willing to be led by scientists in a movement focused on the issue of atomic energy control. However, because the FAS and the NCAI had no clear notion of what kind of activism they wanted from the public, they were unable to realize the potential of the "ordinary housewife." This paper examines the efforts of scientists to forge a tentative relationship with the American public through the NCAI, and argues that the ultimate collapse of the NCAI resulted at least in part from scientists' fears over losing their professional objectivity.

**Antonio Barrera-Osorio**, Colgate University,

*Local Experts, Imperial Agents, and Experience as Common Ground: The Sixteenth-Century Science of the Atlantic World*

This paper discusses the role of local experts and imperial agents in the sixteenth century emergence of empirical practices in the Atlantic World context. Local experts and imperial agents met in houses, villages, hospitals, workshops, ships, gardens, and courts (to name a few sites) where they shared, borrowed, incorporated, and adapted each other practices and ideas—these common-ground sites became, thus, sites of knowledge. In the process, local practitioners and imperial agents transformed their practices. Thus, European physicians learned to use American medicinal plants from "Indian doctors" in Tenochtitlan-Mexico; Indian doctors learned to work in European hospitals. In the process, empirical methods emerged, in part, as a way to validate knowledge provided by Indians, artisans, and imperial agents interacting with each other. In this paper, I discuss reporting and questionnaires as they reflect the emergence of empirical methods to validate personal information and knowledge.

**Cynthia Bennet**, Iowa State University

*Bridging the Gap: Science Service, Scientists, and the Press*

In 1921, Edward W. Scripps, founder of the Scripps-Howard newspaper syndicate, and William Emerson Ritter, who was a biologist and director at the Scripps Oceanographic Institute in La Jolla, California, established Science Service as an organization dedicated to bridging the gap between the scientific community and the public. By gathering science information and disseminating it to newspapers and other periodicals, Science Service responded to the growing public excitement about science and helped scientists gain public support for their research and development endeavors. The directors and editors at Science Service soon became aware that a serious communication gap existed between scientists and the journalists who were supposed to write about their work. Numerous specific complaints from both sides illustrated a lack of understanding, trust, cooperation, and appreciation for the challenges both scientists and journalists faced. This left both sides frustrated and prevented them from accomplishing their goals. Science Service facilitated efforts to close the gap as the science news market expanded. Through the 1920s to the 1940s, the relationship between scientists and journalists improved, only to suffer setbacks in the Cold War period of the 1950s and 1960s, when scientists grew suspicious of the relationship between the press and advertisers, and the press thought scientists were becoming secretive and inaccessible. Science Service continued to facilitate communication between the two groups for the benefit of the public.

**Avner Ben-Zaken**, Harvard University

*Object in Motion: Networks, Trust and Science in the Eastern Mediterranean*

My subject is the cross-cultural circulation of Copernican astronomy in the eastern Mediterranean, and the period I have studied is the sixteenth and seventeenth century, whose records tell us little about manifestations of trust. My departure point was that astronomy is replicated either through mathematics or observation; consequently the need for corroborating observational data and the reliance on astronomical tables, from other locales, demands a sort of trust. However, as a result of various historical circumstances, European and Near Eastern cultures apparently were hostile to each other, and networks of trust rarely existed between them. Under this condition how could science cross-culturally circulate? In this paper I present three cultural mechanisms – exchanges in overlapping networks, communication through common mythological sources and naive encounter with objects - that facilitates our historical investigation concerning cross-cultural exchanges between distrusted cultures.

**Marlous Blankesteijn**, University of Amsterdam, Faculty of Political Science

*Changing bodies of knowledge, policy implementation and legitimacy in Dutch regional Water Management 1970- 2000: Water Boards and their quest for sustainable development*

What is the role of different bodies of knowledge, such as tacit, local and (inter-)disciplinary knowledge, in implementing policies aiming at sustainable regional water management? How does a changing constellation of these bodies of knowledge affect the legitimacy of the interventions in the regional water system that are based on these policies? Tacit and local knowledge (Polanyi, 1967; Yanow, 2000) have always played an eminent role in the famous ‘fight’ of the Dutch against water; particularly within the now 27 Water Boards that manage water at a regional scale. Since the end of the nineteen seventies however, the discourse shifted from an emphasis on fighting water to an emphasis on living with water. A range of national policies invoked these regional developments, most notably the policy of Integrated Water Management introduced in 1985. A consequence of these policies was not only that the autonomy of Water Boards formally decreased, but also that a process of professionalization of their bodies of knowledge was set into motion. Tacit and local knowledge, based on experience and knowledge of the characteristics of the local water system and the socio-political configuration, were now deemed to be less important than abstract knowledge of, for example, the environmental sciences. This particularly affected the legitimacy of interventions in regional water systems. In this paper, I will present an analysis of the changing constellation of the different bodies of knowledge within Dutch water management, within the context of new policy paradigms, professionalization of bodies of knowledge and the discussion of the legitimacy of Water Boards and their interventions. I base this argument on two case studies, based on in- depth interviewing, studying archival material and previous historical research on regional Dutch water management.

**Daniela Bleichmar**, University of Southern California

*The Geography of Observation: Natural History, Place, and Visibility in the Eighteenth-Century Spanish Empire*

This paper explores questions of place, visibility, and mobility in the history of scientific observation. It focuses on eighteenth-century natural history expeditions in the Spanish empire and the ways in which bodies and information traversed distances. Traveling naturalists followed carefully articulated practices of observation and representation that defined epistemologies, methodologies, and communities of practitioners. Visual specificity was countered by, if not predicated on, geographic unspecificity. Natural historians aimed to follow the same protocols of investigation in the Pyrenees or the Andes, in the Spanish countryside or the South American rain forest; they trained their eyes to observe through common procedures that should operate in identical fashion regardless of location. The visual culture of natural history insisted that place did not, or should not, matter. Scientific statements, textual or visual, needed to be true anywhere and to anyone with the skills necessary to interpret them. Rather than depicting specimens, scientific illustration sedimented, incarnated, and transported observations, participating in the erasure of geography.

**Christian Bonahrist**, University of Strasbourg 1

*From arrow poison to IV drug: African plant seeds, C.F. Boehringer Co and the question of standard drugs, 1900-1930*

Paul Ehrlich's 1897 practice of Wertbestimmung (evaluation/standardization) referred to the physiological testing of the effects of ill-defined diphtheria antitoxins. This concept of standardization was subsequently widely extended in terms of its pharmaceutical and economic meaning, being adopted, inter alia, for therapeutic agents produced from plants by a variety of industrial entrepreneurs. The present analysis concerns Strophanthin, a product closely related to digitalis. This therapeutic agent has never acquired the status of a “magic bullet” in the annals of pharmaceutical invention, but is interesting for its “normality” in terms of the tradition of drugs in the occidental pharmacopoeia. Strophanthin, like digitalis, belongs to a classic group of substances first empirically employed in their “unpurified” form as plant extracts with synthesis impossible before WWII. In the meantime, evaluation/standardization of industrially produced preparations required procedures for monitoring the quality of the product. The generalization of the idea and practice of drug standardization will be analyzed in detail and contextualized in their wider political and economic settings in Europe between 1900 and 1938. Two responses to demands for uniformity in the product (maintaining levels of compatibility and similarity) will be considered: stringent control of plant collection and quality control of the end product. Standardization is interpreted as a continual networking process with the central feature that the pragmatic final therapeutic judgment – Strophanthin therapy is safe and works – is as strong and resistant to criticism as the weakest of the connections established in the overall Strophanthin-network that guarantees its clinical use.

**Robert Brain**, University of British Columbia

*From Acoustic Image to Sacred Vibrations: Experimental Phonetics and the Invention of Free Verse Poetry in Fin de Siècle France*

Recent scholarship has demonstrated the importance of physiological aesthetics in nineteenth-century visual arts. I examine similar physiological experiments in vocalization to put poetry on radically new foundations. Poet Gustave Kahn reconceptualized poetry with the “scientific aesthetic” of Charles Henry. Like Seurat and Signac, who used Henry’s physiological aesthetics to conceptualize painting on media of line and color, Kahn defined versification through acoustics of phonation. Kahn undertook experiments in spoken verse in the Collège de France experimental phonetics lab of Abbé Rousselot. Rousselot, famous for graphical recording apparatus and studies of French patois, began experiments in phonetics of verse with French alexandrine form. Experiments in poetic phonation followed with Kahn and linguists/poets de la Grasserie and de Souza. Graphical recordings of vocalization examined rhythmic pulse as a function of syllabic values and accent, rather than syllabism. Poets could abandon prefabricated structures of fixed metric forms in favor of verse around the accent and its intensities, duration of sentiments evoked, or sensation rendered. Poems were constructed out of internal rhythmic or periodic impulse, free movement of acoustic kinships and affinities. Theoretically, free verse allied with ideomotor theories in psycho-physiology, and Wagner’s multi-tonal music, which built leitmotiv out of atomic units of expressive sound. These examples suggest that features of modernism in the arts, including formalism and the ideal of the total work of art, relied on physiological instruments.

**Ingo Brigandt**, University of Alberta

*Continuity in Scientific Concept Use: Homology in the 19th Century Before and After Darwin*

The conventional wisdom about the notion of homology in 19th century biology is that evolutionary theory introduced a novel concept, a post-Darwinian “phylogenetic” homology concept, distinct from the pre-Darwinian “idealistic” homology concept. This idea has been supported philosophically by the tenet that the nature of scientific concepts resides in theoretical definitions, and historically by the (nowadays extensively criticized) assumption that pre-Darwinian biology was in the grip of essentialism. Against the conventional wisdom, the present paper points to important continuities in the use of the homology concept during the 19th century, while at the same time using some of these stable features of concept use as a basis for understanding the adoption of post-Darwinian accounts and definitions of homology. Homology was used in actual research practice in quite similar ways throughout the 19th century, in terms of how homologies were established and how knowledge about homologies was used in morphological, embryological, and taxonomic work. Moreover, before and after Darwin the homology concept was used to pursue largely the same scientific goals, namely the morphological comparison of structures and the classification of species. This historical study of the homology concept motivates some philosophical ideas about concepts. The identity of a concept does not boil down to a theoretical definition, but consists in several aspects (some of which may change in history), including features of practical concept use and the scientific goal pursued by a concept’s use. This latter notion accounts for why novel theoretical definitions are adopted (semantic change).

**Janet Browne**, Harvard University

*Seeing the Gorilla*

Tracing the history of the gorilla in popular culture invites consideration of the ways that humans have projected their hopes, fears and assumptions on to various animal species. This paper draws on representations of gorillas in Anglo-American culture since they first became known in the West. Special attention is paid to Carl Akeley, the pioneering museum curator who led safari and collecting expeditions to Africa in the first decades of the 20th century. Akeley’s ideas about human ancestry, gender and behavior were important in shifting the focus of attention away from ferocity to intellect and mildness.

**David Burke**, Auburn University

*Southern Devices: Atomic Testing In Mississippi, 1964-1966.*

This paper examines the two underground atomic tests conducted in the Tatum Salt Dome near Hattiesburg, Mississippi in 1964 and 1966. The tests were the only two nuclear explosions conducted east of the Mississippi River by the Atomic Energy Commission (AEC) and the Advanced Research Projects Administration (ARPA). The program that these tests were part of, Project Vela Uniform, was designed to develop methods of teleseismically detecting underground Soviet nuclear tests - a technology that was crucial in insuring that treaties intended to limit the yield of underground nuclear weapons tests were being followed. The choice of Mississippi as a Cold War laboratory was due to the presence of enormous subterranean salt formations known as salt domes. These domes offered the possibility of containing the blast, heat and radioactivity of the devices. The test series, site excavation and preparation plans changed dynamically during the development of the test program. The tests themselves were not kept secret - on the contrary, the specific data concerning each test was made public, and the tests were monitored in Soviet block countries, including Czechoslovakia. Despite some minor site contamination, the Mississippi tests contrasted greatly with atmospheric tests conducted in Nevada and the Pacific in that widespread contamination was avoided. The increased standardization and refinement of seismic apparatus resulting from Vela allowed for the accuracy required to pinpoint natural earthquakes as well as nuclear tests, resulting in an improved understanding of geology, in addition to verifying new treaties between the superpowers.

**Conor Burns**, York University

*Between science and history: Archaeological conceptions of the past in nineteenth century America.*

This paper will survey some ways in which a developing science of archaeology shaped perceptions of history and structured narratives about the human past of North America at a time when the nature of science and its relation to broader society was itself undergoing substantial transformation. By the end of the nineteenth century in the United States, a deep rift opened between the academic disciplines of history and anthropology. Partly, this involved the positioning of scientific archaeology as one of four “official” sub-disciplines of anthropology, along with the formalization of “prehistoric” as both the time prior to the arrival of Columbus and also as the stage of development attained by extant native peoples. And yet, throughout the century, some individuals saw archaeology as a critical link between science and history, one with the potential to unite these disparate realms of intellectual inquiry into a continuous whole. Other practitioners viewed the archaeological record as a chronicle of land-use and occupation to which Euro-Americans were only the most recent entrants, a mode of thinking that challenged idealizations of wilderness so dominant within the rhetoric of Manifest Destiny. Archaeology was thus considered capable of imposing notions of continuity onto the past – and our ways of knowing the past – just as much as it was of imposing discontinuity. By specifying precisely how, my goal is to explicate relationships between the human and historical sciences and broader cultural constructions of the past.

**Elizabeth Burns**, University of Toronto

*Perspective in Ptolemy's Almagest and Planetary Hypotheses*

Claudius Ptolemy, the second century A.D. astronomer, describes the motion of the Sun, Moon and Planets using a different frame of reference in the *Almagest* than he does in his later work, the *Planetary Hypotheses*. In the *Almagest* Ptolemy describes the motion of each planet by breaking it down into two different mathematical components: the motion of the epicycle around its eccentric circle and the motion of the planet around its epicycle. Conversely, in the *Planetary Hypotheses*, Ptolemy changes his frame of reference and presents the motion of the planet around its epicycle and the motion of the epicycle around its eccentric circle as one combined motion. According to this second approach, Ptolemy calculates the planetary motions and combines them into one single movement. This forces Ptolemy to take the numbers from the *Almagest* and readjust and recalculate them for the *Planetary Hypotheses*. In this paper I will discuss the two different reference points Ptolemy uses and explore the benefits of each, as well as offer explanations for Ptolemy's change in approach. In addition I will examine how each approach conforms to the objectives of Ptolemy's works in order to obtain a more comprehensive understanding of both the *Almagest* and the *Planetary Hypotheses*.

**Jason Byron**, University of Pittsburgh

*Holism in Early Sexology: Biological and Philosophical Contexts*

Sexology emerged as a field of medicine during the first half of the 20th century. In 1913, three professional societies were formed for the scientific study of sex, two in Berlin and one in London. The following year, the first sexology journal began publication, and in 1919 Magnus Hirschfeld opened the first institute for sex research. Between 1921 and 1932, seven international conferences were convened across Europe. By 1933, little trace of the thriving field remained. Hirschfeld was dead, his associates sent to death camps, and his institute burned. Examining the rise and precipitous decline of German sexology reveals much about medical practice in the Weimar Republic. During this period, experimental physiology and public health began institutionally separating themselves from clinical medicine. While physiology explicitly adopted mechanistic experimental protocols from physics starting in the late nineteenth century (from Hermann Helmholtz, for example), public health allied itself with the Frankfurt Institute for Social Research and its more dialectical approach. Sexology found itself within the interstices of this yawning divide -- bridging eugenics, pathology, epidemiology, and social anthropology while at the same time appropriating the moral authority of traditional clinical medicine. In my talk, I argue that it was precisely the "holistic gaze" of German physicians, that is, their non-mechanistic modes of understanding, that gave early sex researchers their epistemic, moral, and political authority and that presented a growing threat to the agendas of National Socialism.

**Kristian Camilleri**, University of Melbourne

*Heisenberg and quantum mechanics in cultural context: the search for a new Weltanschauung*

By the 1930s physicists such as Bohr, Heisenberg, Pauli, and Jordan had begun to give lectures and papers on what they saw as the philosophical consequences of the new quantum mechanics. Many of these physicists now saw the transformation brought about by modern physics as part of a wider intellectual shift. In doing so, physicists, particularly in the German-speaking world, took up the task of painting a new *Weltanschauung* for the new epoch which dispensed with the mechanistic view which had dominated the nineteenth century. In this paper I examine Heisenberg's own historical-philosophical vision which was most clearly articulated in his 1942 manuscript. As with many of his contemporaries, Heisenberg was convinced that the dramatic transformation that had taken place in modern physics could not be entirely separated from the cultural crisis which lay at the heart of the rapidly transforming social and political world of his time. While at times reluctant about assuming the mantle of *Kulturtrager*, Heisenberg did, on many occasions, speak of modern physics as an expression of the *Zeitgeist*. Here I argue that Heisenberg's efforts to give an interpretation of quantum mechanics from the 1930s onwards cannot be entirely separated from the task he set himself in the 1942 manuscript -- to understand the broader historical-intellectual transformation of the twentieth century. Reading Heisenberg's writings against the background of these wider concerns may also shed new light on his reluctance to ever seriously consider the new interpretations of quantum mechanics which emerged in the 1950s and 1960s.

**Jimena Canales**, Harvard University

*An Eye for and Eye: On Cinematographic Morality*

We frequently ask how the cinematographic camera affects our conception of reality, but can we ask instead how it affects our conception of morality? What shape can discussions on the ethics of this and other technologies take? This essay addresses these questions beyond the usual focus on "use", that is, beyond focusing on ethical or unethical applications of technology. In its place, it investigates the philosophy of technology advocated by the French philosopher Henri Bergson. Bergson's famous statements on the cinematographic camera are considered in the context of his broader discussion of the technology. They are also analyzed as part of his much larger work on other technologies, including clocks, chronographs, telegraphs, automobiles and steam engines. By looking at Bergson's work through this perspective, this essay analyzes the relation between ethics and technology by connecting it to current debates in the history and philosophy of technology.

**John Carson**, University of Michigan

*Cries of "Crisis" in Turn-of-the-Century French Psychology*

By the turn of the twentieth century, French culture in general and French psychology in specific seemed to many to be in turmoil. Celebration of the positivistic and scientific that had characterized the early Third Republic was now strongly criticized by those proclaiming the "bankruptcy of science" and promoting reliance instead on the personal and arational. From Paul Bourget's *Le Disciple* (1889) to Maurice Blondel's *L'Action* (1893) to Ferdinand Brunetiere's *La Science et la religion* (1895), alternative approaches to knowledge, society, and mind challenging the primacy of cold reason and objective science in favor of action, faith, and the spiritual flourished. It was in this context that Nikolai Kostyleff announced in 1911 that there was a crisis in French experimental psychology. In his *La crise de la psychologie expérimentale*, Kostyleff attacked much of the work in French experimental psychology for the previous thirty years as fragmentary and overly concerned with individual capacities at the expense of mental phenomena themselves. After the interruption of scientific research occasioned by World War I, the shift in direction to which Kostyleff pointed became clearly visible within a number of areas of French experimental psychology during the postwar period. In this paper I examine what it was about French experimental psychology that seemed so troubling, both to Kostyleff and to numerous other psychologists. How had the laboratory, which at one point was deemed the guarantor of objective scientific knowledge, especially within psychology, become a suspect site for the understanding of human mental processes?

**Cathryn Carson**, University of California, Berkeley

*Was Heisenberg Really Unphilosophical? Reflections from Practice and Theory*

Wolfgang Pauli famously labeled Heisenberg “unphilosophical”; Martin Heidegger did the same. Of late, most Heisenberg scholarship has followed suit. Without denying that Heisenberg scarcely lived up to Pauli’s or Heidegger’s standards, it is still useful to reclaim a “philosophical” concern in some of his work. We can look at two domains: in practice and in theory. In his practice there is a philosophical thread that even Pauli recognized, in the form of reflections on the correspondence principle (*Anschaulichkeit* and the classical-nonclassical boundary). This thread is persistent; it runs through his most imaginative physical work from the 1920s until at least the Second World War. On the side of theory, his fixation on the subject-object divide drew strength from the preoccupations of late neo-Kantianism. This philosophical discourse, remote from that which interested Pauli, brought him into interesting conversations, the most salient of them being his decades-long, on-and-off exchange with Heidegger. It bears remembering, then, that the label “unphilosophical” is always relative to particular philosophical concerns.

**David Cassidy**, Hofstra University

*Revisiting Heisenberg, Uncertainty, and Quantum History*

During the decades since the completion of the project *Sources for History of Quantum Physics* in 1967, a large number of historical studies have focused on the fertile period of transition to the new quantum mechanics. Most of these studies appeared during the years ending around 1980, when the history of quantum physics attained a certain level of maturity. Subsequent years brought encyclopedic contributions, studies of quantum philosophy, and a trickle of book-length accounts, among them my biography of Heisenberg. A new era of quantum history may now be emerging with the development of new historical approaches to science history, the wider accessibility of primary papers and letters, and a new generation of historians and projects, such as the international effort recently initiated by the Max Planck Institute in Berlin. In light of these developments and the preparation of a new edition of *Uncertainty*, this paper will explore the prospects for a richer, deeper history of quantum mechanics, with a special look at Heisenberg as both an individual and an element of the social, cultural, scientific matrix of physicists that brought about the new quantum mechanics.

**Pratik Chakrabarti**, University of Kent at Canterbury

*“Living versus Dead?”: The Making of the Semple Anti-rabic Vaccine?*

This paper analyses the evolution of the Semple anti-rabic vaccine, developed by David Semple in India in 1911. Semple introduced a peculiarly British approach within the Pasteurian tradition by using carbolised dead virus; a method he adopted from his tutor Almoth Wright’s work on opsonins and vaccine therapy. Pasteur and his pupils, on the other hand, used “living” attenuated vaccine, often associated with the “heroic” vaccination campaigns of late nineteenth century. In 1927, the International Rabies Conference in Paris accepted Semple’s vaccine as the safest and most effective anti-rabies vaccine. The dead vaccine seemed almost free from the neurological side-effects that plagued live vaccines in Europe. It also appeared ideal for tropical climates and for the decentralisation of rabies vaccination in India. However, scientists in India, particularly John Cunningham, had continued extensive research on live etherised vaccine, following the works of Hempt and Alivisatos. Cunningham cited the high incidence of rabies in India and the severity of cases to stress the need for a live vaccine, rather than one which was safe and climatically suited, revoking some of the earlier values associated with live vaccines. The paper studies this unique phase of vaccine research in colonial India, focussing on laboratory experiments on poor patients, moralities and rationalities of dead and living vaccines, balancing of severity of bites, quantities of brain matter in vaccines and risks of paralysis, as well as domestic and international factors, in defining the final configurations of the Semple vaccine, subsequently adopted widely in India and elsewhere.

**Kevin Chang**, Academia Sinica, Taiwan

*Languages, Circulation and Authorship: Publication and Translation of Albrecht von Haller’s Dissertation on Irritability*

Albrecht von Haller first introduced his theory of irritability in a dissertation defended by his student Johann Georg Zimmermann in 1751. This dissertation quickly received great attention across Europe and enticed numerous scholarly responses, in large part thanks to Samuel Auguste Tissot’s French translation (1755). The title page of that dissertation suggests that its author was Zimmermann, whereas we have come to identify Haller as the author of the irritability theory. Who was the author of this text, and who was considered the righteous author by their contemporaries? This paper will sort out the questions on its authorship by studying Haller’s follow-up writings on irritability, Tissot’s writings and his correspondence with Haller and Zimmermann, as well as contemporaries authors’ responses. The early modern practice on the authorship of a dissertation betrays our modern conception of authorship in many regards. This paper aims to elucidate that complicated practice.

**Hasok Chang**, University College London

*Electrolysis before the Modern Ionic Theory: Underdetermination, Closure and Pluralism*

Using 19th-century electrolysis as an illustrative example, I argue against historians’ preoccupation with closure in scientific debates. The electrolysis of water was initially hailed as a novel and decisive confirmation of Lavoisier’s idea that water was a compound of hydrogen and oxygen. However, soon an obvious difficulty emerged: if electricity breaks down each particle of water, why does oxygen emerge from one electrode, and hydrogen from the other, at macroscopically separated locations? Various theories were proposed (invisible transfer, undetectable imbalance, chains of molecules, etc.), none of which commanded a consensus. Ritter and others argued that electrolysis was actually synthesis and water was an element (water + positive electricity = oxygen; water + negative electricity = hydrogen). No closure on this question came until the idea of free ionic dissociation was established around 1900. Thus, a whole century of electrochemistry developed without the resolution of a key foundational debate. Historians tend to gloss over this messy period, focusing on the eventual emergence of consensus. In contrast, I argue that there is much to be gained from more attention to such pluralistic phases of science (neither “normal” nor “revolutionary” in Kuhnian terms). These benefits include the recovery of lost connections (e.g., how electrochemical debates helped sustain chemical atomism), and insights on the process of scientific development (e.g., Ostwald’s view that a repeated “melting down” was necessary to isolate new ideas from older contexts). All in all, we can reach an appreciation of different kinds of work as valid and valuable science.

**Temitope Charlton**, Harvard University

*The Power of Places: Ethnogeography in Thirteenth Century Dominican and Franciscan Missions Accounts*

Learned medieval thinkers saw variations in climate and geography as accounting in part for differences between human populations. Writers in a variety of intellectual and literary traditions drew on contemporary geographical knowledge in their portrayals of encounters, both factual and fictive, with peoples and places beyond the limits of Christian Europe. This paper explores understandings and portrayals of human diversity in religious sources. Geographical knowledge played a significant role in religious representations and perceptions of “other” peoples and places; conversely, religious sources such as exegetical literature, missions writings, and Christian legends also produced new knowledge and ideas about human geography. This paper focuses in particular on thirteenth century missions-oriented travel writings authored by Dominican and Franciscan missionaries to Asia. Such accounts powerfully shaped the geographical imaginations of medieval readers and writers who would otherwise have had no access these worlds. These sources are not, as earlier generations of historians have suggested, examples of a bounded category of “geography” which we might think of as distinctly or essentially medieval. Rather, the numerous medieval sources pertaining to understandings of human diversity are best understood as responses to the particular historical, religious, political, and intellectual contexts in which they were produced.

**Tobias Cheung**, Humboldt-University Berlin

*Playing Music On a Weaving Machine: the relation between nature, science, and technique in Charles Bonnet's statue of organized bodies*

In this paper, I focus on the relation between the order of living bodies, weaving machines, and organs (in French: orgues) in Charles Bonnet's germ-fibres-models of organized bodies. In the second half of the seventeenth century, Girolamo Fabrizio discovered that the microstructures of muscles are similar to artificially produced cloth because they form “tissues”(telae) through interlaced vertical and horizontal fibers. After Fabrizio, Marcello Malpighi, Robert Hooke, and Louis Bourguet also refer to weaving processes and patterns to explain organic tissues. Within the conceptual framework of preformationism and germ theories, Charles Bonnet combines in the second third of the eighteenth century the model of the soul (that plays on the body like a pianist on an organ) with the production process of weaving machines. First, I will highlight some aspects of the transformation and of the epistemological status of different machine models to which naturalists refer in order to explain the phenomena of living beings. Then I discuss the specific role and combination of Bonnet's two major machines through which he distinguishes the natural and the artificial as well as the living and the non- living.

**Tricia Close-Koenig**, Université Louis Pasteur, Strasbourg

*Classifying cancers, standardizing practice.*

Dissecting classificatory frameworks highlights how classifications standardize biomedical entities: the systems encode knowledge and coordinate practice. Geoffrey Bowker and Susan Leigh Star emphasize the invisibility of classification systems once they are naturalized and integrated into routines (Bowker and Star 1999). Tracing the historical construction of classification schemes can reveal the political and semantic negotiations involved. By focusing on classification of cancers in the early to mid-twentieth century, this paper will bring to light dynamics of standardizing biomedical research and practice. The first truly international system for classifying tumours dates to 1987 and the unification of the UICC (International Union Against Cancer) and the AJCC (American Joint Committee for Cancer) TNM classifications. Nevertheless, the founding of the UICC in 1933 marks the beginning of an international effort to exchange knowledge concerning cancer prevention and control. At this time there were, incidentally, a number of local and national schemes in place. Amongst them figures the “Atlas du Cancer” published in 10 volumes between 1921 and 1931 in France. The research work of Pierre Masson, author of the 3rd and 4th volumes of this Atlas, and the routine practices of cancer diagnosis performed at the institute he directed in Strasbourg are indicative of his approach to classification. Here I will align practices in Masson's laboratory and early negotiations for an international classification scheme.

**Deborah Coen**, Barnard College, Columbia University

*The “Social Discovery” of Global Warming*

Spencer Weart's *Discovery of Global Warming* is a revolutionary solution to an awkward problem. The problem is to portray recent climate science in a way that captures the genuine complexity of the interactions among researchers, publics, and objects of study, without producing so baroque an account that a reader might lose sight of the reality of climate change behind the web of competing interests. The solution is an interactive, evolving, hypertext Web site with a narrative that grows just as complex as the reader allows. The result is a highly effective example of the application of the history of science to the public understanding of science, one that bears comparison with other recent portraits of the dynamics of climate research (by Naomi Oreskes, Jim Fleming, and others). *Discovery* is also an explicit invitation to further research, opening the door to a broader view of the history of climate science, including its transnational and pre-1945 dimensions. I will show how *Discovery* has laid the groundwork for a thriving field of climate history, which engages in dialogues with popular and scientific audiences without falling prey to Whiggism.

**Nathaniel Comfort**, Johns Hopkins

*Why is Victor McKusick considered the “father of medical genetics”?*

Google “father of medical genetics” and the first seven hits – and 25 of the first 30 – will refer to the Johns Hopkins physician Victor McKusick. The epithet appears in textbooks and historical articles, often preceded by phrases such as “widely considered to be,” or “universally known as.” Yet McKusick has made no Nobel- winning discovery. He has invented no breakthrough technique. The diseases he studied have been for the most part rare and of limited medical impact. Why is he considered the “father of medical genetics”? I suggest that McKusick's importance to medical genetics is social as much as intellectual. He was a “hub,” a central figure in an expanding social network, at a critical juncture in the growth of the field. A born cataloguer, a tireless organizer, a natural leader, an unselfconscious self-promoter, and a bureaucratic visionary, he had the skills and the resources that connected other researchers to one another. I will use McKusick's research and professional activities in the 1950s and 1960s to illustrate some aspects of the growth of medical genetics and to reflect on the kinds of activities and personal qualities that make a hub. This paper will combine social network analysis with close reading of published literature, archival research, and oral histories. My goal is not just to analyze but also to explain the creation of the social network that laid the foundation for the Human Genome Project.

**Sondra Cooney**, Kent State University

*Did the Land Rise or the Seas Recede? Robert Chambers's Ancient Sea-Margins: Its Contribution to 19th C. Scientific Controversy*

Thanks to the *Vestiges of the Natural History of Creation*, Robert Chambers's contribution to nineteenth-century scientific discussions is well known. Less well known is his *Ancient Sea-Margins, As Memorials of Changes in the Relative Level of Sea and Land* (1848) and its place in another of the century's scientific controversies. Victorian geologists disagreed about how surface features of the earth were formed. Some claimed they were shaped when land was thrust up from under the seas; others said they were revealed as waters receded. Chambers was among the early geologists who were particularly intrigued by the Parallel Roads of Glen Roy in the Scottish Highlands. His studies of them were central to *Ancient Sea Margins*. As he collected data and worked out his theories for this book, he took issue with and departed from the explanations of both Charles Darwin and David Milne-Home. Darwin thought they were produced by upthrusting land; Milne-Home by receding waters. Thanks to Chambers's journals, his correspondence with Darwin, Milne-Home, and others interested in geology, we can assess the contribution *Ancient Sea -Margins* made to Victorian geological debates. Initially attacked for depending upon the same kind of questionable science as the *Vestiges*, *Ancient Sea-Margins*, the value of its data and of Chambers's insights, would not be recognized until the end of the nineteenth and into the twentieth centuries.

**Angela Creager**, Princeton University

*Artificial Radioisotopes and Cancer: Experimental Therapies, Diagnostic Methods, and Risk in the Atomic Age*

This paper addresses the initiatives of the U.S. Atomic Energy Commission (AEC) in the late 1940s and 1950s aimed at supporting cancer research, diagnosis, and therapy. From the founding of the agency, cancer was of concern to the AEC because the double-edged nature of radiation, which could both cause and cure (or at least constrain) human cancer. The AEC's cancer program was thus both a way to address occupational safety issues at the nation's atomic energy facilities and a way to promote civilian benefits of the Manhattan Project. The government propagated hopes articulated in the 1930s by E. O. Lawrence and others that artificial radioisotopes would transform the treatment of cancer, even as growing clinical evidence pointed to the greater utility of radioisotopes in diagnosis rather than therapy. Moreover, the AEC's message that radioisotopes could be used to fight cancer was undercut in the 1950s by growing concern over fallout, which the agency tried unsuccessfully to counter and then contain. New knowledge about the genetic effects of radiation (much of it funded by the AEC) brought to light the potential drawbacks of clinical uses of radioisotopes. In the end, the emergence of nuclear medicine in the 1950s developed against a growing background of public concern – and medical concern as well – about the hazards of environmental, occupational, and even clinical exposure to radioactivity.

**Alex Csiszar**, Harvard University

*Centralizing the Scientific Machine: Bibliographical Controversies at the End of the Nineteenth Century*

The late nineteenth century constituted a marked period of anxiety and dissatisfaction over the organization of science in Europe; the locus of these concerns often came to rest on publication practices and the coordination of authors and readers. One response to this anxiety resulted in the proliferation of specialized indexes, abstracts, and bibliographies for diverse types of professional periodical literature. In 1895 two competing international movements emerged promising to restore order and unity: the Royal Society's International Catalogue of Scientific Literature, and the Répertoire Bibliographique Universel (based in Brussels). This presentation will consider these two projects as contrasting visions for what it could mean to bring order to scientific knowledge production at this historical moment. The one (RBU) envisioned a grand classification scheme that would lay the foundation for a universal tabulation of scientific knowledge, administered via a decentralized network of independent bibliographical organizations. The other (ICSL) eschewed claims to the unity of knowledge per se, and instead envisioned unity as stemming from the administrative centralization of publishing decisions, filtering and imposing strict (though conventional) bounds on what constituted an "original contribution to science." These debates between scientific practitioners over the unity and disunity of science anticipated in more concrete terms later, more philosophical, unity projects beginning in the 1930s. They also suggest that scientific practitioners during this period were at least very aware that certain kinds of disunity were not only a present reality of scientific life, but likely a fundamental aspect of the social structure of science.

**Thomas Cunningham**, University of Pittsburgh

*John Burdon Sanderson Haldane's Intellectual Heritage*

John Burdon Sanderson (J. B. S.) Haldane was a celebrated scientist for his accomplishments in evolutionary theory and for his popular scientific writings. Recently, John Maynard Smith and Sahotra Sarkar have separately suggested Haldane underwent a fundamental shift in his philosophical thinking over his lifetime, and that understanding this allows for an increased appreciation of his public scientific and political publications. In this presentation I challenge these contentions by reassessing J. B. S. Haldane's intellectual heritage. My charge is that we cannot assess the dynamics of Haldane's intellectual commitments without a richer appreciation of his writings and the formative context of his philosophical outlook. Gaining this assessment requires rethinking his father, John Scott (J. S.) Haldane's, philosophical positions as well as J.B.S.' assessment of them. After reconsidering many of J. B. S.' public statements concerning his philosophical beliefs as well as his relationship with his father's views, I conclude that J.B.S.' philosophical perspective exhibited far more continuity than has been claimed by others, and that he never underwent any fundamental changes in his philosophical outlook. Furthermore, I complicate the view that Haldane exhibited a commitment to the metaphysics of Marxism. Instead, I argue that he was an agnostic monist, explain what this means, and how it affects our understanding of this great biologist

**Taika Dahlbom**, University of Turku, Finland

*Specimen, née Example: Zoological Objects of Inquiry since 1655*

The bodies of animals have been used in the production of knowledge about animals since Renaissance curiosity cabinets. What these bodies are understood as, has, however, changed alongside the changing methods of zoological inquiry. What could generally be called "specimens" today have been understood as "examples of creation," "examples of species," "individuals of species," and "samples of a population," for example. Such changes in the conceptualization of the object of zoological inquiry are indicative of how and why knowledge is produced by using zoological objects. In order to look into the changing processes of knowledge production in zoology in relation to the conceptualization of the object of inquiry, I will follow the accumulation of objects of inquiry of a particular fish species and the significations attached these objects from the 17th century to the 20th century in the zoological collections of Copenhagen from Museum Wormianum to the current Zoological Museum of the University of Copenhagen.

**Dane Daniel**, Wright State University

*Complementary Cosmogonies: Paracelsus on the Creations by God the Father and God the Son*

Despite the preeminence of his unique Biblical exegesis in the entirety of his thought, and despite the fact that thousands of physicians and philosophers called themselves “Paracelsians” during the sixteenth and seventeenth centuries – and even proclaimed that they offered a Christian alternative to the “paganism” of the university curriculum steeped in the teachings of such ancients as Aristotle and Galen – the theology of Paracelsus continues to receive scant attention. When it comes to the subject of Paracelsus’ theory of creation, however, the whole of his oeuvre – including his understudied explicitly theological works – deserves in-depth investigation. For example, in the unpublished *Ex Psalterio Declaratio Coene dominij Theophrasti Liber* and the published *De genealogia Christi*, Paracelsus differentiates between the creation by the Father and the creation by the Son. It is impossible to understand Paracelsus’ understanding of cosmology and the nature of the human being without recognizing the differing but complementary contributions of the Father and the Son to the fabric of the universe. The Father’s creations, i.e. the elemental and sidereal bodies, are mortal, destined for ultimate and permanent destruction. The creation by God the Son, on the other hand, is eternal. Paracelsus, drawing heavily from 1st Corinthians, calls this new creation by the Son the eternal body, and also the spiritual body. I will examine how Paracelsus parallels the two creation stories, focusing on his exegeses concerning “creation by fiat” as well as the types of Father-created and Son-created material realities which operate in the world.

**Deepanwita Dasgupta**, University of Minnesota, Twin Cities

*William Jones and S. N. Bose: Scientific Consensus, Intellectual Authority and the Dynamics of Scientific Knowledge-Making in Colonial India*

This paper makes the observation that scientific communities can be classified into two types: metropolitan scientific communities in various Euro-American centers, and peripheral scientific communities situated (mostly) in various non-western locations. Once this distinction is made, the question arises how a scientific consensus is produced when a particular research effort is spread between a center and a periphery. Since scientific consensus is essential for the growth of scientific knowledge, through what kinds of interactions a consensus is achieved between these two? Most models of scientific knowledge assume that consensus is a matter of equal collaboration between communities that results into equal intellectual authority for all communities. In contrast, I argue that the history of the peripheral scientific communities shows us the opposite: interaction between a center and a periphery is mostly non-uniform, and scientific collaborations between two such communities rarely result into an intellectual authority for the peripheral side. The rest of the paper develops this theme through two case studies in colonial India: the botanical researches of Sir William Jones in the 19th century, who employed many Indian artists and collaborators to produce a complete catalog of Indian plants, and the development of Bose-Einstein statistics in 1924, when a young Indian scientist named S.N. Bose solved the long-standing problem of black-body radiation by proposing a new proof of Planck’s law. Both these episodes, I argue, show us that while scientific knowledge may grow through collaborations between a metropolis and a periphery, it is the mostly the metropolitan side that holds the key to intellectual authority.

**Lorraine Daston**, Max Planck Institute for the History of Science

*Collective Observation in Early Modern Europe*

In the course of the seventeenth and eighteenth centuries “observation” emerged as a central epistemic category in the pursuit of knowledge about nature and society. Although individual observers cultivated their skills and observations were increasingly authored, most such activities were understood as part of a collective enterprise. Some phenomena, such as stellar positions or global wind patterns, required networks of observers dispersed over time and space. But even the phenomena of anatomy, medicine, physics, and natural history came to be seen during this period as objects of multiple observations conducted in a series, in order to establish the range of variability and to eliminate the workings of chance. Collective observation posed social, logistical, and epistemological challenges: how to recruit observers, especially on a voluntary basis; how to channel their attention and standardize their instruments and descriptions; how to coordinate their often disparate reports into a stable result; how to construct series for rare phenomena that could not be subjected to repeated scrutiny? The methods for solving these problems ranged from the questionnaire distributed to travelers to standardized forms for weather-watching, from the creation of epistolary communities to the homogenization of observation reports. Tools included the pre-printed table, the notebook, and the library – all ways of collecting, correlating, and comparing observations, past and present. The aim was to forge a single, stable, robust observation out of many fleeting, variable, individual observations: to meld many pairs of eyes into a single Argos-like super-observer.

**Joseph Dauben**, Graduate Center, CUNY

*Western Mathematics in the Middle Kingdom: Elite versus Grass Roots Strategies*

When Western science was first introduced to China in the late Ming and early Qing dynasties, it was largely through efforts of the Jesuits and other Catholic orders. As is well-known, figures like Matteo Ricci targeted the elite of the imperial court and high administrative officials, believing that if they could convince them of the superiority of western science, the superiority of western religion would follow. To some extent they were successful in this venture until the rites controversy eventually resulted in a prohibition by the emperor Kang Xi in 1721 of any further missionary activity in China. When western missionaries returned in the latter half of the nineteenth century, it was largely Protestants who sought to convert the populace at large, and they did so by establishing schools and writing textbooks, some offering systematic introductions to the sciences, including mathematics. This presentation will focus on the specific examples that the history of mathematics in China can offer to explain how these different strategies affected the development of a new and revitalized mathematics in modern China. Its basic argument is that the “grass roots” approach – spurred by western influences in the late nineteenth century – was crucial to the creation of a new class, literally, of Chinese mathematicians who helped spearhead the transformation of Chinese society, largely through education and the emergence of a professionalized cadre of mathematicians. Such a transformation could never have been achieved through an “elite” approach to the subject like that advocated in the seventeenth century.

**Raf De Bont**, University of Leuven

*'So full of Romance, so Unspoiled, Rough, Rugged and Primitive': The Bird Observatory in Rossitten and 'experimental' field culture*

In 1901, the former theologian Johannes Thienemann founded the bird observatory of Rossitten at the Kurish Spit, East Prussia. The station was the first of its kind in the world. Just like the foundation of marine laboratories (from the 1870s onwards) and hydrobiological stations (since the 1890s), the establishment of ornithological stations would trigger important changes in the research questions and the concrete practices of field biology. In my paper, I want to address these changes by focussing on Rossitten. Thienemann's objectives were manifold. He wanted to study the behavior and migration patterns of the many birds that traversed the Kurish Spit; he wanted to establish a bird collection and procure material for neighbouring research institutes; he wanted to study the protection of birds and their economic value. Furthermore, he wanted to 'civilize' the backward region in which he worked and to undergo the romantic thrill of its ruggedness. Although attracted by the 'wild' character of the Kurish Spit, Thienemann manipulated the nature in which he worked in many ways. He conducted tests with artificial nesting and purposive hunting; he ringed birds and worked out release experiments; he put up observatories and attracted naturalists and tourists. Although he romanticized the loneliness of his workplace, Thienemann mobilized an unseen number of amateur collaborators for his ornithological project. In my paper, I want to throw light on these various activities, which were all part of a plan to master the extended habitats of the highly volatile research objects under scrutiny.

**Soraya de Chadarevian**, University of California Los Angeles

*Genetics and public health in the 1960s*

The development of new methods for visualizing and analyzing human chromosomes in the 1950s and 1960s did not only lead to the introduction of new diagnostic techniques in the clinic, but went hand in hand with expanding projects aimed at investigating the genetic make up of human populations. In Britain this work was spearheaded by the radiologist and medical researcher Michael Court Brown. Following his work with the epidemiologist Richard Doll on the leukemia-inducing effect of radiation treatment based on the review of 14 000 patients he employed cytogenetics techniques to investigate the chromosomal constitution of the general population as well as for epidemiological studies aimed at correlating specific karyotypes with specific clinical pictures and to investigate the chromosome damaging effects of certain agents. With the same aims in mind he also promoted the establishment of a National Register of Abnormal Karyotypes, an initiative that introduced many clinicians to the new techniques of karyotyping. The paper will deal with the techniques and the aims that propelled these studies and with the controversies that surrounded them. It will also discuss the place of these studies in the broader context of postwar biomedicine.

**Fabio De Sio**, Stazione Zoologica Anton Dohrn, Napoli

*Western science and the octopus. The unkept promises of a laboratory animal*

Since Aristotle, Octopus has been object of much interest from Western naturalists. From Pliny to contemporary scientists, observations and speculations on its aesthetic qualities and impressive behavioral capacities have followed one another, building up the image of an animal too smart for its phylogenetic status. Since the late XIX Century, the simple report of curiosities has been supplanted by attempts to give an objective account of its abilities. I will try to reconstruct the career of Octopus as a wonder mollusc, especially considering the debates on its behavioral capacities and their presumed incoherence with the animal's mode of life. I wish to focus here on the attempt to use the octopus as an "objective" model for the study of the material substrates of behavior, based on its presumably contradictory nature of "invertebrate with a vertebrate behavior" (Boycott and Young, 1950). I will argue that the failure in making the octopus a model for a reductionist account of complex behavior (i.e. the impossibility of isolating any "pure" memory mechanism in its brain) resulted not only from technical difficulties, but also from its being at the same time, amenable to experimental treatment ("simple" organism) and resistant to any reductionistic account ("complex" behavior). Such resistance, in the long run, led researchers to acknowledge the heuristic importance of a biographical approach, i.e. of coupling observation and experimentation, and framing the account within the domain of natural history. The animal, in such a context, exceeded the technology, becoming an active agent within the experimental system.

**Richard Delisle**, The University of Chicago

*Humanity's Uncertain Boundaries Until the 1930s: A Late Consensus on Slow Zoological and Paleontological Surveys*

It is perhaps not sufficiently realized that the currently accepted zoological and phylogenetic boundaries of the human condition were only arrived at during a fairly recent historical period. Indeed, one has to wait until the 1930s for the naturalists and the anthropologists to reach a consensus on the broad contour of these boundaries, thus putting an end to several centuries of uncertainties accompanying the naturalization process of the worldview. Whereas Linnaeus recognized in the mid-eighteenth century two distinct human species living in contemporaneity, some scholars were still expecting in the 1920s and 1930s the possible discovery of human-like primates in the least known regions of the globe. Furthermore, human phylogenetic debates starting in the 1860s turned out to be another source of uncertainty about humanity's boundaries, especially since the polyphyletic thesis which was held by perhaps as much as twenty different scholars between 1860 and 1930 threatened to enlarge humanity to the point of incorporating a significant portion of the Primate Order within its confines. The unity of the human species as narrowly conceived today is a recent scientific event. This much had to be established before ethical issues, among others, could profitably be tackled.

**Eli Diamond**, Dalhousie University

*Aristotle's Account of Vision as Instrumental to his Account of Thinking in De Anima*

In *De Anima* III.5, Aristotle famously compares the active intellect with light, a comparison which demands that the reader consider the analysis of mind in relation to his earlier analysis of vision and light. By juxtaposing *De Anima* II.7 on vision and light with his chapter on the active mind, I show that every single detail of Aristotle's analysis of vision has an exact analogue in his analysis of thinking. Reading II.7 on vision and III.5 on active intellect together in this rigorous way makes sense of why Aristotle included precisely the details he did in his examination of the role of light in seeing, an examination which might otherwise appear somewhat unorganized and confusing. To bring out how his analysis of light and vision in II.7 is determined by the metaphysical and theological concerns at the heart of *De Anima*, I will compare this chapter to the more empirical account of vision and light in *De Sensu*. In doing so I hope to bring further clarity to the difference between the theoretical interest of *De Anima* and the more empirical orientation of the other biological works.

**John DiMoia**, National University of Singapore, Department of History

*"Let's Have the Proper Number of Children and Bring Them Up Well!": Family Planning, Biomedicine, and Nation-Building in South Korea, 1961-1968*

This paper looks at the formation of a South Korean national health network by focusing on the introduction of an ambitious National Family Planning (FP) Program under President Park Chung Hee (1961- 1968). The program, influenced in part by the model of its neighbor, Taiwan (Taichung), saw two pilot studies carried out in Koyang (rural) and Sundong-gu (Seoul metropolitan area), before being carried to rural areas. If the program bore numerous echoes with Japanese colonial practice, it was mobilized specifically in terms of the emerging South Korean state and its relationship to the welfare of the individual family unit. Using a range of Korean and English-language sources, I will illustrate how the FP effort handled these uncomfortable traces of the recent past (e.g., the Ota ring, introduced by Japanese doctors in the 1930's, versus the "modern" Lippes loop). With the contributions of international actors, South Korean public health officials would create one of the world's most effective population programs – here defined in terms of reduction of the birth rate – by the late 1970s. At the same time, however, the program's legacy carried with it a deeply ambivalent record, particularly as the South Korean case resulted in a strengthening of the state's claim over the bodies of its citizens.

**Peter Distelzweig**, University of Pittsburgh, History and Philosophy of Science

*De Artificio Mechanico Muscularum: The Mechanical Problems in William Harvey's De motu locali animalium*

Most scholarly attention given William Harvey has centered on the *De Motu Cordis* of 1628 and its reception. This focus is not without reason, as it is to this work that his near contemporaries gave most attention and (eventually) praise. Disproportionately little attention has been given to his other, much more massive publication on the generation of animals; and even less still has been given to his various unpublished notes. Among these latter is a collection of notes on the local motion of animals and the anatomy of the motive organs, particularly muscle; it was edited and translated by Gwenneth Whitteridge and published as *De Motu Locali Animalium*, 1627(MLA) in 1959. Though generally overlooked in the limited literature on these notes, Harvey displays here a significant preoccupation with mechanics and the role of mechanical reasoning in anatomy. In these notes we find a number of more (and sometimes less) obvious allusions to the pseudo- Aristotelian *Mechanical Problems* and a clear sketch of the nature of mechanics and its place in the study of the anatomy of muscles. In this paper I examine this feature of MLA, focusing particularly on how Harvey conceptualizes the place of mechanics in anatomical explanation. Besides its intrinsic interest, this work sheds some light on the complicated interaction between Harvey's Aristotelian project in anatomy and the developing mechanical philosophy by pointing to an underappreciated element of the situation: Harvey's familiarity with the sixteenth and seventeenth century tradition of pseudo-Aristotelian mechanics.

**Meghan Doherty**, University of Wisconsin-Madison

*Faithorne's The Art of Graveing, a Language of Accuracy and the Royal Society*

This paper argues that over the course of the seventeenth century engraving and etching came to be accepted as providing transparent representations of the natural world for the visual communication of science in the circle surrounding the Royal Society in London. London in the 1660s served as the primary location for this change. Collaboration between artists and members of the Royal Society helped to break down the stigmas surrounding the use of printed images in natural history, in particular. William Faithorne and his wide array of printed output are the foci of this discussion. Faithorne was an important node in the networks of individuals involved with the myriad activities of the Royal Society from its founding in 1660 to his death in 1691. Faithorne is an apt case to study because in addition to engraving many portraits of well-known intellectuals and members of the royal family, he also engraved the illustrations for a number of books published by members of the Royal Society and the images in his own treatise on the art of engraving. In 1662 Faithorne published *The Art of Graveing and Etching*, which outlines the best practices for creating an engraving or an etching. It is this book, I argue, that works to make engraving a scientific endeavor by systematizing the method for producing intaglio prints and working with a language of accuracy.

**Matthias Dorries**, Universite Louis Pasteur

*'Nuclear winter' and global climatic change*

This paper proposes to revisit the nuclear winter debate within the context of the last years of the Cold War. Recent research in the history of science has shown how greatly research in the environmental sciences depended on military funding from the 1950s on. Still, until the 1980s, potentially severe environmental consequences of nuclear war were largely accepted as unfortunate byproducts of necessary military build-up, a worthwhile price for peace. The debate about nuclear winter brought a new twist by challenging this argument, turning it against itself. Nuclear war was no longer about the unprecedented in scale though ultimately local destruction of cities and military installations, but about the possibility of global long-term destruction of the whole earth's climate. Among scientists, the detractors of this kind of environmentalism pointed to 'nuclear winter's' shaky scientific foundations, denigrating it as a mere distraction from keeping pace with the enemy, a danger to peace and rational thinking. After 1989, both parties claimed victory. The article explores the history leading to these claims of victory: Was the 'nuclear war debate' the beginning of the end of the Cold War (as some scientists claim), or was it rather a lively but ultimately unimportant sideshow carried on by a few scientists? Or was it the first hint of a new age of global environmental concerns that could only reach full bloom after 1989, within a 'new world order'?

**Heather Douglas**, University of Tennessee

*The Philosophy of Science Association as an Interdisciplinary Society*

Although the subject of philosophy of science had been of interest to philosophers in North America for more than a generation by the end of World War II, what the boundaries should be for that subject and who was a legitimate practitioner was far from settled. In the 1947 by-laws of the Philosophy of Science Association and editorials published in its journal, PSA was defended as a society open to multiple approaches and definitions of philosophy of science. The practices of the organization reflected this ecumenical view. For example, the PSA met annually as part of the AAAS throughout the late 1940s and 1950s, meetings that often involved other societies as well. On the governing board for the PSA and the editorial board for the journal, scientists were heavily involved in the running of the society. And the topics covered in the journal, *Philosophy of Science*, reflected this broad view of what counted as philosophy of science. By the late 1950s, however, arguments had been voiced that philosophy of science as a subject should be more narrowly construed. The PSA became a more professional society partly as a response to a demand for more consistent quality in the journal, partly through more stringent vetting of membership applications, and partly through a marginalization of the voices calling for continued openness and interdisciplinarity. This talk will examine the nature of PSA prior to 1960 and the pressures that would push the PSA to become a more inwardly focused disciplinary organization.

**Otniel Dror**, The Hebrew University of Jerusalem

*Cultures of Adrenaline*

“This is hallelujah day! De la Paz and I get clear evidence of emotional production of adrenalin in cat.” [Walter B. Cannon, Diary entry for Jan 16, 1911]

On or about January 16, 1911, human character changed. This play of words on Virginia Wolff’s famous hyperbole, in which Wolff encapsulated the radical changes in Western culture “from Protestant salvation in the next world to therapeutic self-realization in this one” captures the contemporaneous and no less significant shift from the era of the “blush” to the era of “adrenaline” and of “excitements.” Adrenaline emerged during the early twentieth century at a most opportune historical moment. It was the essence in which a materialist culture invested its spiritual energies. It was the liquid, which encapsulated the emerging critiques of the “pleasure economy.” And it was an (evolutionarily) archaic source of energy in the modern body. Adrenaline also embodied—at first only insidiously—the anti-hedonistic pleasures of engaging in masculine endeavors, like sports, wars, and fear-seeking activities. In this presentation I will study four different dimensions of adrenaline, as these emerged during the first several decades of the twentieth century: 1-- the shift from blush to adrenaline; 2--Cultures of Adrenaline; 3--Man the Machine: Fatigue and Adrenaline; 4--The Pleasure of Adrenaline Pain. My ultimate aim will be to exemplify the cultural and biological potencies of adrenaline, and its progressive presence in—and domination of—a wide spectrum of private and public realms in Western culture.

**Matt Dunn**, Indiana University

*Dobzhansky’s Evolutionary Genetics: Natural Populations or Mirroring Morgan?*

Dobzhansky’s break with the Morgan lab was driven by a shift in interest from the mechanisms of inheritance to the relationship between genetics and evolution. Kohler (1994) argues that the Morgan group was interested in eliminating and controlling genetic variation in order to study inheritance whereas Dobzhansky was interested in “carefully preserving” genetic variation from natural populations in order to study how it was shaped by evolutionary processes. Gannett and Griesemer (2004) agree that patterns in natural variation were the focus of Dobzhansky’s work and argue that these data were used to test claims about the “causal mechanisms” of evolution. While I agree that much of Dobzhansky’s work can be characterized following these authors, his work also closely mirrored Morgan’s in important ways not previously appreciated. I argue that once *D. pseudoobscura* “invaded” Dobzhansky’s lab, he began making use of the experimental resources it provided by tinkering with various geographical races to construct artificial flies purpose-built to address specific evolutionary questions about, for example, the founder effect. In some of his work, he did “carefully preserve” natural variation, but in other experiments he pruned and manipulated that variation to suit his needs. Moreover, I argue that the experiments with these constructed flies are more obviously tests of the “causal mechanisms” of evolutionary theory than are the patterns of geographic variation discussed by Gannett and Griesemer.

**Matthew Eddy**, Durham University

*The Grammar of Anthropology: Hugh Blair, Print Culture and Human Origins*

During the Enlightenment the University of Edinburgh trained a numerous naturalists who went on to have a profound affect on the language used to create systems of natural history published in Britain and its colonies. Until recently, the curriculum used to teach such students was addressed in relation to books that were the domain of professors lecturing in the medical faculty. While this has helped create an informative picture of how binomial nomenclature and notions of species infiltrated lectures of professors like William Cullen, Joseph Black and Alexander Monro Secundus, the textual tools of description and ordering provided by the courses of Arts faculty professors have received little attention. This paper fills part of this lacuna by focusing on the lectures of Hugh Blair, the university’s professor of Belle Lettres and Rhetoric. I suggest that his thoughts on the history of language and literacy provided a helpful rubric for anthropologically orientated observations taken by medical students sitting in his course who eventually obtained commissions in the British navy that took them to posts in North America, Africa and Asia. More specifically, I concentrate on his belief that language was intimately linked to the operations of the human mind and how this led him to present a detailed system that accounted for the origins and meanings of the languages and texts of Europeans and cultures that were located in contemporary colonial settings.

**Michael Egan**, McMaster University

*Vernacular Knowledge and Expertise: The Center for the Biology of Natural Systems and the Science of the Environmental Crisis*

During the 1960s, in response to the growing number and severity of perceived threats to the environment and public health, a new scientific praxis was developed that highlighted the popular feeling that environmental decline was an objective feature of the era. This paper investigates the development of a public or vernacular science after World War II, which constituted a blending of scientific expertise and political activism to address these environmental threats. This account rests on two postulates: first, that this new form of scientific activism played a critical role in redirecting American environmentalism during the 1960s and 1970s, and, second, that the dissemination of vernacular science transformed relationships between experts and publics as well as relationships between different communities of experts. My vehicle for this account is the Scientists’ Institute for Public Information (SIPI), an umbrella organization whose organizing platform was to provide “information unencumbered by political or moral judgments” that was “freely available to all.” SIPI was founded in 1963 by some of the more politically engaged scientists of the post-war era—Margaret Mead, René Dubos, and Barry Commoner were among its founders—who acknowledged the public and political nature of scientific information and sought to produce accessible knowledge to encourage non-experts to participate in environmental debates.

**Josh Ellenbogen**, University of Pittsburgh

*Impressed Images*

My paper examines late nineteenth-century concepts of sense-impression, above all as these were developed around particular practices in scientific photography (Francis Galton, William Abney, E.J. Marey, Alphonse Bertillon). What warrants bringing this group of investigators together is the shared idea of “impression” that underwrote their endeavors, an idea that gave a temporal component to seeing. That is, all these commentators took seeing to consist in what Galton described as “a series of infinitesimally short impressions constantly being made on the eye through time, so that what we see at any moment consists in the cumulative effect of sub- units of impression, as these have collected on the eye during the previous tenth of a second.” What is most instructive about this strange way of construing vision is not just that a very large number of influential investigators adhered to it, but that it was modeled on particular techniques in scientific photography from the time. My paper, thus, will also examine the forms of reciprocity that obtained between concepts of seeing and material imaging practices.

**James Elwick**, York University

*A 'certain compulsion upon the authorities': 19th century competitive written examinations, objectivity, and educational reform*

From the 1850s on, competitive written examinations spread rapidly through English education, and historians of science from Roy MacLeod to Andrew Warwick have looked at how they changed the teaching of science and mathematics. This paper discusses how marginalized groups used such exams to enter the formal system of science schooling in England and elsewhere. For instance, those seeking university degrees for women used exams to their advantage - educational reformer Emily Davies (1830-1921) thought that the anonymity of written exams gave women the chance to be assessed by the same standard as men. This paper uses research on objectivity by HPS/STS scholars to understand Davies's point and the claims of other campaigners. It argues that the explicit rules that governed written exams were used to hold educational institutions to account. The very format of written exams allowed women who scored just as well as men to clearly demonstrate their achievement, and thus make a moral claim on an educational institution for equal treatment. Indeed new perspectives on objectivity may shed some light on a more general historical phenomenon: why written exams were so closely linked to the 'reform' of nineteenth-century educational institutions.

**Richard England**, Salisbury University

*Beyond Christian Darwinism: The Rev. John Gulick on Science, Religion and the Limits of Language*

John Gulick (1832-1923) was a missionary to Japan and China, but is best remembered as an evolutionary theorist. George Romanes called him the most important living author on Darwinian topics, and his work on the role of isolation influenced Sewall Wright. Gulick held that behavioral evolution shapes biological changes, and was an early champion of the Baldwin effect. He is still hailed by biologists as a prescient theorist. Gulick's writings are generally technical, but what little he wrote on the wider implications of evolutionary theory show how he held science, religion and morality in a unified worldview. All three were aspects of the reason which pervaded nature: ultimately, he considered even religion as explicable in natural terms, and yet he did so in a way that was not entirely naturalistic. A theme in Gulick's biological work is the careful definition of terms, and his theological ideas are also shaped by his concern for the meaning and limits of language. While Gulick's interpretations of particular issues verged on a reverent agnosticism, he held that the central facts of Christianity remained unchanged in the face of science. Historians often consider Darwinian evolution the most naturalistic challenge to religious commentators, but in this case, an ordained evolutionist promoted another naturalistic vision of evolution which went beyond natural selection, and, through an analysis rooted in careful definition of terms, remained committed to his faith. Drawing on manuscript and published sources, this study locates Gulick's views in their historical (and historiographical) context.

**Jonathon Erlen**, University of Pittsburgh

*History of Science and Technology Materials in the European Union Library and Archives*

The European Union (EU) has been deeply involved in promoting and funding history of science and technology research for the past half century. This involvement has been carefully documented in the EU Library and Archives that contains over 16, 500, 000 unique pages of primary documents. This treasure trove, previously housed in the EU Embassy in Washington, DC, has been transferred to the Hillman Library of the University of Pittsburgh and is available for researchers. This poster will highlight some of the major history of science and technology areas covered by this material, focusing on the following major fields: medicine/public health; atomic energy; biotechnology; aeronautics; agriculture; environmental concerns; information technology; and energy. Selected titles pertaining to each of these fields will demonstrate the breadth and scope of this collection. Potential researchers will be directed to contact the collection's curator, Dr. Phil Wilkin.

**Kristina Espmark**, Umeå University, Sweden

*When Science is Paradise: Research and Boundaries in Astrid Cleve von Euler's Scientific Career*

In 1902, the Royal Swedish Academy of Sciences conferred an award on young Ph.D. Astrid Cleve (1875-1968) for her work on the rare earth element ytterbium. A botanist as well as chemist, Cleve also did extensive work on diatoms for which she was made professor honoris causa in 1955. In 1962, she claimed to have found the worldly location of the biblical Paradise in a northern part of present Germany. Astrid Cleve (married von Euler) became Sweden's first female doctor of science in 1898 and was determined to pursue a scientific career. For various reasons, however, she failed to secure a place in institutionalised science and continued as an independent researcher throughout her life. With varying success she worked within chemistry, botany, Quaternary geology, archaeology and anthropology, and though her critics differed in opinion, she considered her work and method scientific. Nonetheless, with limited access to academic resources, her work developed under different conditions than research within institutionalised science. This paper - which is a summary of my forthcoming Ph.D. thesis on Cleve's life and science - explores how Cleve's research developed over time in relation to both her life in general and to institutionalised science. Furthermore, I interpret that development by using Thomas F. Gieryn's concept of boundary-work, thus aiming to gain further understanding of Cleve's scientific career in particular and of the relationship between non-institutional research and recognized science in general.

**James Evans**, University of Puget Sound

*Students as Weapons: The Lyon Theses On Le Sage's Theory of Gravitation (1770)*

Like many good Newtonians, Georges-Louis Le Sage (1724-1803) of Geneva was an atomist, but he went further than most, for he believed that even gravity could be explained by the collisions of atoms. Le Sage imagines that the observable universe is bathed in a sea of ultramundane corpuscles. Two bodies that appear to pull on one another are actually pushed together by the rain of corpuscles from outside. By 1770 Le Sage's theory was well enough known in France to be the subject of a disputation at Lyon. There, a student named Charcot defended some theses under the presidency of Professor P.-F. Champion, and the theses were published in broadsheet. But Charcot's theses were actually composed by the abbé Pierre Sigorgne (1719-1809), who used Charcot to publically examine Le Sage's theory. This led, naturally enough, to dispute and recrimination. Sigorgne was a well known popularizer of both Newton and Leibniz who had taught at the Collège du Plessis until he was accused of writing satirical poems mocking the court. For his role in the "Affair of the 14," he was stripped of his job and banished from Paris. The Affair of the 14 was the subject of an interesting treatment by Robert Darnton; but the Lyon episode has never been studied. In this talk, I will unpack the episode and work out the behind-the-scenes relationships of the figures involved. This will shed some light on the conduct of academic disputes in eighteenth-century France.

**Zach Falck**, Independent Scholar

*Advocating Ecological Practices as Environmental Activism: Frank Egler and Rights-of-way Management in the 1950s and 1960s*

The post-World War II environmental movement in the United States gathered force as talented and energetic scientists explained the environmental problems of American life and persuaded many Americans to be concerned with them. Historians have analyzed how Rachel Carson, Barry Commoner and Paul Ehrlich commanded public attention and stimulated the nation's environmental consciousness. For many other scientists, however, environmental activism involved beseeching colleagues and competitors to think ecologically rather than reaching out to mass audiences. These scientists advanced conservation ideals and were committed to shaping environmental management policies and practices among public and private actors, entities, and organizations. This paper will examine ecologist Frank Egler's relationships with businesspeople, agricultural and biological research scientists, rights-of-way managers, and public officials – managers, technicians, and professionals who lacked knowledge of or training in plant ecology. Throughout the 1950s, Egler promoted the utility of ecological knowledge in the management of transportation, communication and power transmission corridors and advocated these strategies on behalf of the public. Egler's struggles to convince policymakers and scientists to adopt new methods reveal how the limitations and obstacles constraining scientists working inside organizations and among experts and decision makers exposed environmental problems. While he continued working to influence rights-of-way management, Egler also studied how organizations that resisted reworking their seemingly ecologically-destructive practices produced knowledge, attempted to shape public attitudes and formed networks to undermine the environmental movement. Egler's career permits further historical investigation of the boundaries between scientific communication and activism.

**Fa-Ti Fan**, Suny-Binghamton

*An American Entomology in China: J. G. Needham and His Chinese Colleagues*

This paper examines the Cornell entomologist J. G. Needham's connections with Chinese biologists in the 1920s and 30s. At Cornell, Needham trained a number of Chinese students who would later play a major role in the development of biology in China. Needham himself visited China in 1927-28 and, with the help of his Chinese colleagues, he wrote a monograph on the dragonflies of China. In examining the case of Needham and his Chinese colleagues, this paper considers two aspects of modern science in national and inter/transnational contexts; they are (1) the translation of scientific practice and knowledge from one society to another (in this case, from the US to China and vice versa) and (2) science in the intersection of nationalism and internationalism.

**Uljana Feest**, Technische Universität Berlin

*Edmund Husserl and the Crisis of Philosophy*

In 1936, the philosopher Edmund Husserl published his article, "The Crisis of European Sciences and Transcendental Phenomenology." The article was based on several lectures that he had given the previous year, one of which was entitled, "The Crisis of European Sciences and Psychology", another "Philosophy and the Crisis of European Mankind." In this work, he laid out what he took to be the crisis of science, i.e., that its progress relies on the elimination of subjectivity, thereby failing to be relevant to human life. My paper has several aims: (1) to use Husserl's analysis of crisis to throw light on the works of other authors concerned about the crisis of psychology; (2) to place both Husserl's and other authors' analyses within the broader context of early 20th century discourse of crisis and reconstruction; and (3) to show that while Husserl's diagnosis of the state of philosophy and the sciences remains unchanged from 1900 to the mid 1930s, the word "crisis" only appears in the 1930s. I argue that while Husserl early on viewed philosophy as having taken a wrong turn (failing to provide an adequate treatment of human subjectivity, science, and rationality), this conviction reached a climax towards the end of his life, when his own life became deeply affected by the rise of Nazism. I conclude with a discussion of the relationship between crisis as an actor's term, and the historical circumstances in which it was employed.

**Suzanne Fischer**, University of Minnesota

*Apologia for Quackery: Medical Entrepreneurship and the Problem of Efficacy*

Is "quackery" a useful analytical category for understanding the history of medicine? Medical practitioners who have engaged less than reluctantly in market activities such as advertising have often been categorically tagged "quack." Despite the embeddedness of medicine in market activities, medical entrepreneurship has been treated differently in the historiography than other medical practices. In particular, the historiography of quackery suffers from a double standard defined by a focus on efficacy. My research on "men's doctors" who treated syphilis in the 1910s illustrates a diversity of medical business practices as well contemporary contestations around medical legitimacy. Using the example of men's specialist quacks' advertisements for syphilis treatment, both before and after Salvarsan, I demonstrate the historiographical use of the concept of efficacy to dismiss fringe practitioners. Further, I argue that the negative connotations around "quackery" and its lack of clear definition call for a more robust analysis of medical business.

**Donald Forsdyke**, Queen's University, Canada

*William Bateson's unacknowledged debt to Charles Darwin's research associate George Romanes*

That geographically isolated races could become distinct "species" had long been known. Edmund Catchpool noted (1884) that, although anatomically differentiated, such races often remained reproductively compatible and so were not species. If the barrier were removed the races might cross to produce fertile offspring. True reproductive isolation would usually require anatomical (or physiological) differentiations over long periods. But "races" occupying the same ground could be reproductively isolated (i.e. they were distinct species) even when anatomical differences were minimal (or even absent). Catchpool's proposal that isolation had been achieved by unspecified internal mechanisms was independently advanced in 1886 at the Linnean Society by George Romanes (1848-94). With knowledge of Michael Guyer's observations on the chromosomes of sterile hybrids (1900), Bateson proposed an internal mechanism for speciation and (with prompting from C. R. Crowther) agreed that many small differences between homologous chromosomes might cumulate to prevent their meiotic pairing, so generating hybrid sterility (i.e. reproductive isolation). Although reminded by Joseph Cunningham of Romanes' work, Bateson dismissed him as a "paper philosopher." Romanes' Linnean lecture had been given while Bateson was on an Asian expedition without access to journals. However, a letter to his sister, Anna, shows that he received copies of *Nature* containing the lecture and supported Romanes' views. Like Romanes, he read, but failed to understand Samuel Butler, who with Ewald Hering, first saw heredity in informational terms (see: "Treasure Your Exceptions." *The Life and Science of William Bateson* by A. G. Cock & D. R. Forsdyke, Springer, NY, 2008).

**Michael Fournier**, Dalhousie University

*Boethius and the Consolatio quadrivii*

Although Boethius wrote on all four mathematical sciences, we have only his *De musica* and *Institutio arithmetica*. While these works provide hints about his understanding of the relation that obtains between the sciences, I consider the evidence from the *Consolatio* to shed new light on how Boethius understood the quadrivium. The sciences appear in the *Consolatio* as various forms of the orbis (circle or sphere). The presentation of the sciences in this context provides a concrete example of how they are for Boethius a ladder which leads from the sensible to the intelligible. Astronomy is considered in the first book, where the circle of the stars is the key to the Prisoner's recovery of sensation. Music is considered in the second book's famous presentation of the wheel of Fortune to the Prisoner's ailing imagination. Geometry is considered in books three and four in accounts of the circle of creation and the circle of Fate. The former is exemplified in the mythico-rational central poem, which owes much to Plato's *Timaeus* and Proclus's commentary on it. The latter moves from a consideration of mathematics as the principles of the sensible to a consideration of geometrical form (specifically the relation of circle and center) as an image of a higher reality. Finally, arithmetic, and in particular the way that in it the multiplicity of number and in fact the principles of all the sciences are contained in unity itself, is coordinated with the account of the simultaneous presence of all time to eternity.

**Alan Gabbey**, Barnard College, Columbia University

*Hamlet and Other Machines*

Hamlet signs off his letter to Ophelia (Act 2, Scene 2) with these curious words, "Adieu. Thine evermore, most dear Lady, whilst this Machine is to him, Hamlet." According to the OED, this is the first appearance in printed English (1604) of "machine" in the sense of a living body, especially the human body. Does Hamlet really see his body in a proto-Cartesian light, rather than as a piece of lowly stage machinery, or as an instrument in the mechanics of the plot? These questions reflect the early modern historian's problem in dealing with the "machine" concept. One line of attack is to ask: what kinds of machine would have been thought of then as "natural kinds", and in what senses? Hamlet the human being belongs to a natural kind, as do the Cartesian machines that constitute human and animal bodies. What about those artifactual machines that serve as paradigms of explanation in mechanical philosophy? If they belong to natural kinds, are they products of nature after all, and what therefore explains their own actions and properties? If they do not belong to natural kinds, how can they as artifactual structures explain "natural" phenomena?

**Marilyn Gaull**, Boston University

*Romantic Climates: "A sunny pleasure-dome with caves of ice"*

In the common conversation of art and science during the Romantic period, climate was visualized as shifting either to heat or to cold with similarly dire Malthusian consequences, plague, starvation, conflict, and death. The solutions, many believed, lay in altering human behavior either morally, if one were religious, or through inventions if one were scientific, micro-climates from parasols to steam engines, heat and energy-producing machines which powered the Industrial Revolution. All gradations and responses were recorded in poetry and art, Blake, Wordsworth, Coleridge, Constable, Turner, but, above all, Erasmus Darwin.

**Sander Gliboff**, Indiana University

*Morphology strikes back: Richard Semon and a counter-revolt against genetics and experimentalism*

Classic accounts of biology around 1900 depict an almost Kuhnian "revolt against morphology," and even though this picture has been much revised and qualified, it still captures the perspective of evolutionary morphologists like Richard Semon (1859-1918), who saw himself as defending an old order against experimental *Entwicklungsmechanik* and genetics. Semon is now best known to historians of psychology for his Mneme theory of organic memory, but he actually began his career as an acolyte of Ernst Haeckel's, a tropical traveler and collector, and author of a landmark work on the morphology of the Australian fauna. Following a scandalous elopement with the young wife of a senior professor in 1897, his academic job prospects and access to laboratory space dwindled, so he took up theoretical work—just in time to counter the revolt that was threatening to make his previous research obsolete. In a series of books, he argued that the new experimentalism made unwarranted generalizations that ignored variation, history, and the uniqueness of every individual. His Mneme theory was as much a contribution to biology as psychology, and was intended as an alternative account of all the same phenomena as *Entwicklungsmechanik* and Mendelian genetics. It would dispense with hypothetical hereditary particles and mysterious processes of mutation, and save as much as possible of Haeckel's older synthesis of evolution, development, and heredity.

**Benjamin Goldberg**, University of Pittsburgh

*De Generatione Animalium and the New Science*

*De Generatione Animalium* (1651) represents more than twenty years of anatomical investigation and philosophical speculation on the part of William Harvey. Yet the work has generally been ignored by both philosophers and historians of science though *De Generatione* is a tour-de-force of methodological and philosophical sophistication. First, I discuss Harvey's argument for epigenesis and put it in historical and intellectual context. Harvey's epigenesis has three main elements: (1) development of form over time, part by part; (2) a teleological character, that is, the parts are for the organism as a whole; (3) the insistence that there is no pre-existing matter upon which the embryo is formed, and that, as a corollary the processes of nutrition and generation are identical. The third element of Harvey's theory also relies upon his postulation of a novel theoretical entity, namely, the ovum. Next, I argue that Harvey's Aristotelianism provided a better initial home for the project of reconfiguring physiology and medicine than early mechanism. Finally, I will discuss the fact that though historians contrast preformation with epigenesis, this is not Harvey's contrast. As a result of his postulation of ova in vivipara and his observations of fetal development, this comparison is a non-starter for Harvey. Rather, he contrasts epigenesis with metamorphosis, which we shall see is much closer to spontaneous generation. The contrast in Harvey's work is not between epigenetic and preformationist theories of generation, but between epigenetic and morphogenetic processes of generation, both of which occur in nature but in different sorts of organisms.

**Mirjam Goller**, Humboldt University of Berlin

*Cybernetics as Model in Russian Philosophy from the Modernist Age to Nowadays Thinking*

My paper will show the specific and productive combination of mathematics and philosophy in Russian thinking that can be described in terms of cybernetics. Prominent Russian and Soviet thinkers deal with the idea of a dialectical and processual unity of physical and metaphysical aspects. This idea is virulent from the modernist – symbolistic – age to contemporary philosophy. The concept of the symbol and the all-unity (*vse-edinstvo*) in Solov'ev and – earlier – in the philosophical mathematics of Nikolai Bugaev influenced the following generation of philosophers as well as the aesthetic development of the Russian avantgarde. Pavel Florenskii and Aleksei Losev, tried to combine religious and scientific explorations of the world as a productive and complementing unity. Merab Mamardashvili and Aleksandr Piatigorskii, protagonists of the Moscow methodological circle from the late fifties and early sixties on, designed a theory of thinking, which include the individual sphere as well as a collective, the linguistic as well as the bodily, the immanent as well as the transcendent, without dropping these dichotomic terms of Western philosophy. I will probe the basic concepts of the named philosophers in respecting different cybernetic models.

**Graeme Gooday**, University of Leeds

*Purity vs Property? The Patenting context of constructing “pure” and “applied” electricity 1880-1920.*

Historians have long noted the problems raised by attempts since the mid nineteenth century to differentiate between “pure” and “applied” science. Ronald Kline (1995) rightly concludes that uses of this mooted demarcation were typically value-laden, partisan and above all rhetorical. Unsurprisingly then, historians tend to appeal instead to Thomas Hughes (1986) notion of a “seamless web” of science, technology and society that undercuts any such bifurcating distinction. Yet refined historiographical sensibilities do not help us explain either the broad discursive resilience of the pure/applied dichotomy from the 1880s, notably by Henry Rowland (USA) and Oliver Lodge (UK), or the rejection of it by such eminent figures as William Thomson (Lord Kelvin). This paper explores one contemporaneous development that helps to explain the bipartisan intensity of such concerns in this period: the huge rise of patent claims (and associated litigation) that characterized the rise of the electrical industries of telephony, lighting and power. While Rowland, Lodge and Thomson all took out patents in electrical technology, only the lattermost was comfortable with funding his physical researches from the royalties thereof. We thus explored how Rowland and Lodge both made characteristic pleas (following the 1870 call of London chemist Alexander Williamson) for an independently funded “pure science” that would spare them from this ruthless - and thus ungentlemanly - pursuit of intellectual property. This paper thus shows how an understanding of this phenomenon helps us to some extent to explain how a “pure physics” eventually emerged in the twentieth century, seemingly disentangled from both its electro-technical premises and applications.

**Matthew Goodrum**, Virginia Tech

*Defending Australopithecus as a Human Ancestor: Raymond Dart, the Osteodontokeratic, and Tool-use as a Criterion for Establishing the Phylogenetic Status of Hominids.*

When Raymond Dart described the first Australopithecus fossils in 1925 there was general scepticism about his assertion that the specimen represented a human ancestor. The anatomy of the fossil and its geological age were too poorly known to convince sceptical anthropologists that Dart's interpretation of it was correct. However, between 1945 and 1960 Dart discovered more Australopithecus fossils at a site called Makapansgat, along with a substantial number of animal bones. Soon Dart became convinced that many of the animal bones found at Makapansgat showed marks of having been modified to be used as tools. On the basis of these observations Dart proposed that Australopithecus had used bone, teeth, and horn tools. Since only humans use tools Dart argued that this “osteodontokeratic” culture of Australopithecus proved that they were well on the way to becoming human and were a direct ancestor. This raises issues about the criteria used by paleoanthropologists to determine the phylogenetic status of new hominid fossils.

**Melinda Gormley**, Oregon State University

*German Émigré Geneticists in America, 1930s & 1940s*

As demonstrated by the rich scholarly literature on physicists' relocations during the 1930s, historians recognize the important role in these immigrations of international scientific networks and an individual scientist's reputation. Refugee literature often focuses on scientists whose lives tell a success story. The Manhattan Project, in particular, received sizeable financial support, provided many refugees with jobs, and its employees were considered important to the war effort. Thus, the experiences of these refugees should be viewed as unique. In contrast I will explore some biologists' personal and professional experiences. Four German biologists who had a smooth transition in America cultivated ties to their homeland by remaining in close contact and looking out for one another. They were Richard Goldschmidt, Curt Stern, Ernst Caspari, and Joachim Werner Braun. One geneticist who did not have a positive experience was Victor Jollos. The American geneticist L.C. Dunn served on two refugee committees, the Emergency Committee in Aid of Displaced Foreign Scholars and Columbia University's Faculty Fellowship Fund. His role in assisting his émigré geneticist colleagues is an important element in this story.

**Christopher Green**, York University

*The Mind in the Urban Jungle: Chicago's Psychology in the 1890s*

It has become popular to study the impact on the character of a scientific endeavor of its having developed in a certain location. The impact of a particular place on the development of psychology may have been nowhere more significant than in Chicago in the 1890s, where labor strife, immigration tensions, and class struggle threatened the city itself. The Railroad Strike of 1877, the Haymarket bombing of 1886, the Pullman boycott of 1894, led to fears that civil war was at hand. The University of Chicago opened its doors in 1892. Its philosophy department centered on John Dewey, and three of his junior protégés, James Hayden Tufts, James Rowland Angell and George Herbert Mead. Dewey and Angell would founding the first indigenous American school of psychology, Functionalism, which was grounded, in part, in the Darwin-inspired psychological writings of William James. More than that, however, Chicago Functionalism constituted an effort to make academic psychology relevant to the profound social and economic problems the city was facing. As Tufts put it, in ethics texts, “little if any attention was given to the economic problems which the nineties were disclosing. I felt the necessity of a method of viewing the moral life that would show its deep routes in human nature and social situations.” Concrete urban concerns were the cradle not only for Dewey's famed “laboratory school” and educational theory, but also for Angell's psychological teachings, Mead's “social behaviorism,” and Tufts' ethical writings. This presentation will examine those connections in more detail.

**Elizabeth Green Musselman**, Southwestern University

*Breaking Through: Meteors and Universal Knowledge in Colonial South Africa*

This paper explores how colonial and metropolitan astronomers transformed local astronomical phenomena (like meteors) into material that could enter the scientific record. More importantly, it will explore how and why colonial and metropolitan astronomers found Africans' (Khoekhoe, San, Xhosa, Tswana) notions of the heavens lacking the quality of universal knowledge. I will argue that the "missing" pieces in African technique were mathematical calculation and what educated Europeans would recognize as a theoretical vision of the cosmos. I will further explain what the documentary and material records tell us about southern Africans' alternate conceptions of universal knowledge.

**Julie Grissom**, University of Oklahoma

*Homo vermiculosus: Nicolas Andry and 18th Century Parasitology*

The advent of widespread use of the compound microscope for scientific investigation in the mid-seventeenth century led to a flourishing of research into parasitic organisms, especially worms, and their role in disease. Although historians of medicine have written about the history of parasitology, almost all of these studies begin with the formal establishment of parasitology as a scientific discipline in the latter half of the 19th century. The preceding two centuries of parasitological research remain relatively unexamined. In this talk I argue that parasites, especially worms, were important explanatory mechanisms for a wide range of diseases in the 18th century. Thus the neglect of 18th-century parasitology by historians of medicine means that we've missed a crucial aspect of medical theory in this period. My focus in this talk is on the work of the French physician Nicolas Andry du Bois-regard (1658-1742), who, referred to as "homo vermiculosus" by his peers, provides an excellent starting point for a discussion of parasitology in this period. Andry's practical helminthology text, *An account of the Breeding of Worms in Human Bodies* (1701), is illustrative of the importance of worms in eighteenth century medical theory as the potential source of a remarkable number of diseases. I argue that not only does this work demonstrate the extensive production of parasitological knowledge, particularly through microscopic investigation, but also that Andry's numerous references to the experiences of other physicians, through the inclusion of their illustrations, case histories, and letters, provide evidence of contemporary widespread interest in parasitology.

**Katja Guenther**, Harvard University

*A Body Made of Nerves: Early 20th-Century Neuroscience and the Rise of Cerebrocentrism*

In modern neuroscience, the prime object of inquiry is the brain. This interest is reflected in broader culture, where the self is often located within the brain's physically defined limits, from "brain in a vat" philosophies to brain death. But the brain has not always been the main focus of attention. In the early 20th century, an important but now much-neglected clinical tradition considered the brain to be part of a larger whole. It was the nervous system in its entirety that elicited contemporary interest - the disembodied brain was an inconceivable abstraction. This paper studies the case of Breslau neurosurgeon Otfried Foerster and his work on the neural axis. Foerster's procedure of surgically removing the anterior roots of the spinal cord was widely used across Europe in the early decades of the 20th century as a treatment of last resort against intractable pain and spastic paralysis. The success of the operation is impressively documented in photographs taken in Foerster's clinic at Breslau, and in a film from 1910 by his Belgian colleague Arthur van Gehuchten, one of the earliest neurological films in history. After WWI, Foerster used a similar technique on the brains of patients with post-traumatic epilepsy because he saw the brain as an extension of the spinal cord. But ironically, these procedures on the brain, which assumed the continuity between brain and body, have informed the cerebrocentric tradition that asserts their division.

**Vincent Guillin**, College de France

*Five Ways of Being a Scientific Phalocrat: Auguste Comte's Biological Arguments for the Subjection of Women.*

In recent years, Comtian scholarship has insisted on the crucial role Auguste Comte, the founder of modern positivism, ascribed to women in the moral regeneration of modern societies. However, Comte's acknowledgment of women's social role never extended to a belief in the reality, or even the possibility, of sexual equality. As far as he was concerned, the patriarchal order was built to last, for women's intellectual inferiority was a natural fact that nothing could undo. And by nature, Comte here understood the biological nature of the female sex. In my paper, I will review the various biological arguments adduced by Comte in support of his belief in the natural intellectual inferiority of women, paying particular attention to the way they appeared in Comte's correspondence with one of the most eloquent voices of 19th century women's rights movement, namely John Stuart Mill. My paper intends to show that, despite Comte's reliance on classical biological and medical arguments for women's intellectual inferiority (drawn from anatomy, physiology, developmental analysis and inter-specific analysis), what is characteristic of his sexism is its commitment to phrenology: whereas generations of physicians used to maintain that "Total mulier in utero", the new "cerebral physiology" of Gall and his associates claimed that "Tota mulier in cerebro". That was exactly the core of Comte's "scientific phalocratism".

**Cai Guise-Richardson**, Iowa State University

*Neurotic Dogs, Drunken Cats: Jules Masserman, Horsley Gantt, and the Development of Animal Models of Neurosis, 1930-60*

Animal models of mental illness, developed in the mid-20th century, informed the rapid development of psychopharmaceuticals after 1950. Understanding the models' rationale illuminates mid-century concepts of mental illness, particularly anxiety and neurosis. These models were part of an attempt to understand the nature, cause, and cure of maladaptive behaviors. Rooted in contemporary understandings of psychology and psychiatry, animal neurosis researchers merged neurologic and psychologic models of mental illness. Animals were taught conditioned responses, and anxiety produced by conflicting signals or altering expected stimulus response patterns, thereby setting up conflicts between past and current experience. Jules H. Masserman and Horsley Gantt were pioneers in developing animal models of neuroses. Working with various mammals, including monkeys, dogs, and cats, they built on the work of Pavlov and modified it to fit mid-20th century theories and issues. Masserman's animal models of neurosis played an important role in the mid-20th century psychosomatic interpretation of health, in which neuroses had and could prolong physiological problems through psychosomatic feedback. Gantt worked more openly within a psychodynamic interpretation of neurosis development, arguing neuroses involved internal frustration and conflict, the mental life of the animal. Although their experiments with neurotic dogs and drunken cats appear bizarre in hindsight, they illustrate the profound differences between mid-20th century and early 21st century interpretations of mental illness and psychosomatics. These models help explain development of anti-neurotic drugs, such as Valium, and the rationale for their widespread use in the 1950s and 1960s.

**Matt Gunterman**, Yale University

*The Germ in the Chalice: A Case When Science Met the Sacred*

In this paper I examine the religious artifact both as an expression of scientific understanding and as a mediator of emergent scientific knowledge within religious communities. I do so by analyzing the controversy that erupted in the late nineteenth century among American Protestants as proponents of the germ theory of disease began their challenge of the sanitary quality of the traditional shared communion chalice. My specific concern here is a discussion of the material culture produced through their efforts to impose sanitary reform on the traditional communion ceremony. The designs of these sanitary communion forms, which are recorded in patent applications, advertisements, and in surviving specimens, fell into two categories: those that centered on the use of individual cups by communicants and those that featured a chalice so modified as to conform in some sense to sanitary standards. The scriptural legitimacy and use of individual communion cups, which proved to be the more popular and commercially successful sanitary reform, was justified in light of germ theory through a shift in emphasis from the communion ritual as a moment for the sharing of the substance of the wine to one of the sharing of experience, which was the act of communing. The modified chalice, however, reflected a desire to protect communicants from one another's germs while preserving the traditional communion pattern and the appearance of shared substance. Finally these modified chalices provide a means to engage how their makers understood the implications of germ theory around 1900.

**Sanem Guvenc-Salgirli**, State University Of New York At Binghamton

*From Public Health to Eugenics: The 1937 Typhus Epidemic in Istanbul*

The outbreak of typhus epidemic was not an extraordinary phenomenon for Istanbul. The city had lived through many of such episodes throughout its history. Yet, in 1937 typhus created an unprecedented panic among the public, the city chroniclers, newspaper columnists, and municipality. Over the course of three months, from June till September 1937, approximately one thousand cats and dogs were exterminated; porters and beggars were banned from traveling within the confines of public spaces; public baths were closed down; street vendors were forced to be vaccinated; owners of the grocery stores were forced to do health check-ups and strict rules were enforced by the municipality concerning the order of the streets. This paper seeks to discuss the uniqueness of this situation, and the diversity of the public health measures to annihilate typhus. It argues that one of the reasons for the panic was the concentration of the virus to poorest quarters of the city, accompanied by fear of the poor as the main carriers of the disease. Equally important was the social context of the 1930s, in which the debates on eugenics were heightened and its practice gained a widespread acceptance from the public. This paper suggests that the typhus epidemic of 1937 was not an isolated, but an important case where the boundaries between public health and eugenics were transgressed.

**Paul Halpern**, University of the Sciences in Philadelphia

*The Tragic Final Years of Paul Ehrenfest*

Physicist Paul Ehrenfest had extraordinary talents as a teacher, mentor and original thinker. At Leiden University during the 1920s, he hosted an impressive array of visitors, served as an important sounding board for Einstein, advised Samuel Goudsmit and George Uhlenbeck as they developed the theory of spin, and stimulated important discourse in general about quantum and statistical physics. Ehrenfest's final years, however, from 1930 to 1933, were marked by severe self-doubt and depression, culminating in suicide. Through an analysis of his correspondence with family members, including his older brother Hugo, an esteemed obstetrician working in St. Louis, we will detail his desperate attempts to grapple with emerging physical theories, find a new position in the United States, and deal with a dire economical situation and pressing family matters including finding care for his son Wassik who had Down Syndrome.

**Orit Halpern**, New School for Social Research

*Architectures of Communication: Cybernetics, Temporality, and Perception in Post-War American Design*

This paper will examine historical transformations in the relationship between the image, time, and knowledge after the war. One site to investigate these changes in representation is at the locus of science, design, and architecture in the works of Charles and Ray Eames and Gyorgy Kepes for the Center for Advanced Visual Study at MIT and in the interests of science education. In these works the nature of the image, the materiality of vision, and the relationship between documentation and communication was aggressively being rethought. All of these projects were deeply invested in the emergent terms of cybernetics and electronic media. Ontology, documentation, and representation were seemingly replaced by discourses of communication, performance, and modularity. The world as interface for the mediation of on-going, lively communicative exchanges. In their work we can find evidence of a more global reformulation of the work of the document, the relationship between abstraction and materiality, and between science, aesthetics, and visuality.

**Vivien Hamilton**, University of Toronto

*Physics in use: Models of electricity in 19th century electrotherapy textbooks*

Electrotherapy, the popular 19th century practice of applying various types of electricity to the body for medical benefit, occupies only a small corner of standard medical histories, and fails altogether to appear in most histories of physics. Indeed, textbooks outlining the principles of electrotherapy for the practicing physician may seem to be an obscure resource for a historian of physics, but they prove extremely helpful in developing a picture of the state of physics knowledge as it existed beyond the professional boundaries of the physics community. Those who practiced electrotherapy often appealed to physical principles of electricity in their struggle for professional legitimacy. An understanding of the nature of electrical phenomenon separated legitimate practitioners from quacks. In their widely read treatise on electrotherapy, the American physicians George Beard and A. D. Rockwell declare, "No one can be a master in electrotherapeutics without also being a master in electrophysics," and the 1881 edition of their book begins with an 80 page introduction to the physics of electricity necessary for the successful operation of electro-medical devices. This paper takes a close look at the physics in Beard and Rockwell's textbook, examining in particular the relationship between the physical models in the book and contemporary theories in physics. Echoing recent work on popular science, we find that the physics in the book is not merely a passive simplification of contemporary electrical theory, but a creative and autonomous knowledge system, shaped by the particular practical concerns of the practicing physician.

**Kimberly Hamlin**, Miami University (Ohio)

*Bearded Ladies, Hypertrichosis, and Evolutionary Anxieties about Gender, 1878-1900*

In 1878, at the very first meeting of the American Dermatological Society, the doctors coined a term for a disease that afflicted scores of their female patients: “hypertrichosis,” the disease of excessive hairiness. Previously tolerated as normal or at least inevitable, female facial and body hair was now a disease to be combated. What accounted for this shift? In this paper, I place hypertrichosis in the context of the reception of Darwin’s *The Descent of Man and Selection in Relation to Sex* (1871) and *The Expression of Emotion in Man and Animals* (1872) and argue that the disease was a manifestation of American’s anxiety about evolutionary theory and its implication that humans and animals evolved from common ancestors. Among the most controversial elements of *The Descent* was Darwin’s explanation of the loss of female body hair. Darwin suggested that, over time, women had selected mates with beards, while men had chosen the least hairy mates, which explained why the two sexes differed so greatly with regard to body hair. Compared to other animals that varied widely in appearance according to sex, facial and body hair were among the few visible signs separating men from women and, thus, important markers of gender and evolutionary advancement. Hairy women, then, were not only less female than their smooth-skinned sisters but also more closely related to their primate cousins. In discussions of hypertrichosis, then, doctors, patients, and the public were also puzzling over what it meant to be human, animal, male, and female.

**Gary Hardcastle**, Bloomsburg University

*A “Coalition Dominated by the Unorthodox”: The Beginning of the Philosophy of Science Association*

Philosophy of Science debuted in January of 1934 as the self-described “organ” of the newly-formed Philosophy of Science Association. Its initial eleven-member editorial board included some well-known philosophers of science – Rudolf Carnap, Herbert Feigl, L. Susan Stebbing, and Morris Raphael Cohen – and others whose presence is rather surprising, like the mathematicians E. T. Bell, Dirk Struik, and Alexander Weinstein, the physicist-turned-legal scholar Walter Wheeler Cook, the geneticist Hermann Joseph Muller, and the psychologist Karl Lashley. Matters are much the same regarding the Journal’s Advisory Board, in which the names of scientists and mathematicians usually dissociated from the philosophy of science outnumber philosophers ten-to-one. It was a “coalition dominated by the unorthodox,” wrote the journal’s first editor, William Malisoff. Perhaps this eclecticism reflects nothing more than the youth of the discipline of philosophy of science and a corresponding strategy of having prominent scientists to lend their names to the new journal. But perhaps not. This talk examines whether the Philosophy of Science Association and its journal were indeed created to reify and advance a particular discipline or profession, the philosophy of science. I’ll be interested particularly in laying out the early history of the Association and its journal on the basis of archival materials and in uncovering the motivation and vision of those who created it.

**Laura Harkewicz**, University of California, San Diego

*“Selective Illumination:” Using the Scientific Uncertainty of the Bravo Medical Program to Establish “Changed Circumstances”*

“Selective illumination” is the use of knowledge based on the user’s relationship to it. It is apparent in the way uncertainty related to knowledge about the fallout exposure of citizens of the Marshall Islands from the 1954 Bravo thermonuclear test has been mobilized in Marshallese claims for increased compensation for damages from the U.S. Nuclear Testing Program in the Pacific (1946 – 1958). On-going compensation claims rest in part on the concept of “changed circumstances,” which provides for renegotiation of compensation should evidence emerge suggesting that knowledge about environmental or medical conditions have changed. How and why has the knowledge changed? Classified documents released in the mid-1990s revealed information about government-sponsored human radiation research, including the medical histories of the Marshallese. These documents contain data that continue to be analyzed resulting in a multiplicity of conclusions. Much of this data were collected by scientists of the “Bravo Medical Program,” which was conducted for over 40 years and had the dual purpose to provide medical care to the exposed as well as produce knowledge about the biological effects of exposure to radioactive fallout. I argue that the Program’s dual goals were a major cause of tensions that developed between the Marshallese and Program scientists, and that these tensions are evident in the changed circumstances debate. This paper explores how scientific uncertainty about Bravo evidence prevented closure to the debate and supported the selective illumination of knowledge.

**Steven Harris**, Harvard University

*Trading Zone or Battleground? Power, Knowledge, and ‘Nature’ in 17th-century New France*

Jesuit missionaries and indigenous peoples of the Great Lakes Region met in a “middle ground” where they bartered knowledge and beliefs as well as pelts and beads. Like their trade in material objects, exchange of knowledge was without common currency and never between equals. I propose to approach the question of asymmetric power relations in Jesuit appropriation of indigenous knowledge by examining two seemingly unrelated fields: the cartography of the Great Lakes and materia medica from the same geographical region. By juxtaposing indigenous (principally Algonquian) knowledge of landscapes and curing practices with Jesuit accounts of the same, I hope to show that, like the physical territory itself, the human body was a battleground. For Jesuit missionaries, what was at stake was not so much “possession” of an individual district, body, or soul, but the establishment and promulgation of a conception of “Nature” that segregated the “natural” from the “supernatural” (e.g., natural versus spiritual cures), permitted its uncircumscribed use for human ends (natural resources versus sacred gift), and yet insisted on its subservience to the absolute monarchy of a Euro-Christian god. The Jesuits’ taxonomy not only stood in stark contrast to the highly individualized, phenomenological character of Algonquian cosmology, it structured Jesuits’ assault on virtually every aspect of that cosmology. This case study suggests that, with regard to conceptualizations of the physical body and its environment, the metaphors of “trading zone” and “middle ground” fail to capture the contentiousness of knowledge appropriation along cultural frontiers.

**Peter Harrison**, University of Oxford  
*God and Early Modern Natural Philosophy*

The identity of natural philosophy has been a major preoccupation of historians of science in recent years. Claims that natural philosophy is significantly different from modern science have focused on such questions as the role of religious considerations in natural philosophy, the balance between theory and practice, the relative priority of action and contemplation, and the status of mathematics. In many of these discussions attention has been focused on disciplinary boundaries as they were understood in the past, and on the content of the relevant disciplines. This paper sets out a different perspective on these questions by proposing that we think about medieval and early modern disciplines not only in terms how they divided intellectual territory, but also in terms of how they were understood as contributing to different aspects of moral and intellectual formation. Such an approach enables us to frame the question of the relationship between science and religion in the early modern period in a new and potentially fruitful way. It also leads to the conclusion that both Medieval and early modern natural philosophy could be “about God,” albeit in rather different ways.

**Gary Hatfield**, University of Pennsylvania  
*Koehler, Koffka, and the “Crisis” in Psychology*

During the 1920s and 1930s, Koehler and Koffka each responded to the perception of a “crisis” in psychology. In reviewing Driesch’s 1926 book, Koffka affirmed a crisis in psychology’s handling of meaning. He rejected Driesch’s solution based in vitalism and reanalyzed the problem in familiar Gestalt terms: previous psychology was caught up in “machine theory” that construed the primary data of psychology as meaningless “sensory elements,” whereas the Gestaltists recognized as basic phenomena of human experience organized wholes imbued with meaning. Koffka and Koehler emphasized that any psychological solution to the problem of meaning must come through natural scientific methods and theories, and they insisted that meaning and value could be objects of natural scientific psychology. Koffka, who had moved to the US in 1927, later explained that in introducing Gestalt psychology to an American audience he portrayed a different “crisis” than he would have for a European audience. In America, he emphasized basic scientific failings in previous psychological theory; in Europe, he would have emphasized the problems of meaning, value, and culture -- or meaning writ large. I compare these two strategies of emphasis in the writings of Koffka and Koehler.

**Amy Hay**, University of Texas -- Pan American  
*‘The Quickening Conscience’: Scientists Protest Agent Orange*

In December of 1969, the American Association for the Advancement of Science Board announced its intent to investigate the possible ecological harm caused by the spraying of Agent Orange in Vietnam. A number of scientists attending the 1969 meeting expressed their support of the Council’s decision. While some worried about the ill effects caused by other kinds of technology throughout the world, not just in Vietnam, or thought there was little chance that scientists’ objections could affect war policy, some viewed the AAAS decision as “the quickening conscience of the American scientific community.” Scientific protest about the herbicide campaign specifically, and about biological and chemical warfare more generally in the 1960s and 70s, focused on the harm done to the environment and people of Vietnam, and has received little historical examination. The concerns prompted controversy, as the scientific community was as divided as the general American public over whether Americans should be fighting in Vietnam. Using government documents, published writings, journal articles, and interviews, this paper examines the genesis of scientific protest, major actors, and their efforts to stop what would be later called the “ecocide of Indochina.” It argues that scientists’ objections composed a significant sector of Americans protesting the war, and these scientists represent an important presence in a scientific community often condemned as unthinking collaborators in an unjust war.

**David Hecht**, Bowdoin College  
*Scientific Americans: Nuclear Physics and Nationalism after Hiroshima*

This paper explores cultural conceptions of “science” and “the scientist” in the early Cold War. It begins with a rhetorical analysis of the work of Robert Oppenheimer, the “father of the atomic bomb,” whose public discourse after World War II was significantly constructed around hallowed American names and traditions; Oppenheimer cited Thomas Jefferson to advance idealized notions of science’s virtues and Abraham Lincoln to defend the wisdom of eschewing short-term needs in favor of long-term political vision. He also regularly harkened back to Enlightenment ideals, using them to link the promise of scientific progress with the founding principles of the United States. Not all prominent nuclear scientists used such patriotic imagery, but dozens of like-minded scientist-activists shared and clearly articulated a political vision that melded American democratic ideals with a scientific version of secular humanism. Though the policy goals of such activists usually met with only limited success, their rhetorical and ideological choices had a significant cultural reach outside of the realm of direct political advocacy. Many Americans rejected scientists’ more radical political suggestions, while simultaneously adopting and recasting the admiration for traditional scientific and national glory that suffused the rhetoric of Oppenheimer and others. This paper explores the ways that scientist-activists and the public adapted similarly idealized visions of science in very different ways – to celebrate, challenge, and complicate the cultural place of science and scientists.

**John Henry**, University of Edinburgh  
*Isaac Newton: Biblicalist or Deist?*

The late Professor R. S. Westfall suggested in a number of essays that Isaac Newton was effectively a deist. This view has either been specifically rejected, or silently dismissed, in more recent studies of Newton’s religion. This response seems to be based on the assumption that it makes no sense to consider someone who spent as much time and energy as Newton did in studying Holy Scripture to be a deist. Deists, after all, rejected the role of revelation in religion in favour of reason. But this assumption is by no means unassailable, as Professor Westfall’s conclusion shows. Westfall knew as much about Newton’s obsessive study of Scripture as anyone, and yet he still saw Newton, albeit perhaps in spite of himself, as a deist. This paper will reconsider and reassess Westfall’s claims, with a view to determining what Westfall meant by suggesting Newton was a deist, and whether he was correct.

**Ellen Herman**, University of Oregon

*“At Risk”: Why Childhood Matters for History of Science*

The calculation and management of dangers – from morbidity and mortality to unemployment and climate change – have been inextricably linked to the progress of quantitative methods, as historians of science and technology have frequently noted. Historians of gender and family in twentieth-century U.S. history have emphasized the centrality of women and children to social welfare programs designed to protect citizens from harm, while intellectual and cultural historians have interpreted the rise of a “therapeutic ethos” as a development central to modernity and the spread of consumer capitalism. This paper engages these fundamental insights from three different areas of scholarship in order to trace the history of risk. First, it will ask why children have served historically as the prototypical “at risk” population, uniquely vulnerable to a host of “risk factors” that have been subject to both measurement and multiplication over time. Second, it will briefly consider the case of child sexual abuse after 1945. When and why did this issue, so often shrouded in secrecy and shame, become a compelling subject of research in the human sciences and biomedicine? How did clinical and empirical inquiries shape legislation and policy related to preventing child sexual abuse as well as promoting novel interventions designed to help children and families recover from trauma? What can it teach us about the cultural authority that science has exerted over definitions of selfhood, citizenship, and government in the modern United States?

**Volker Hess**, Charité Berlin

*Standardizing values - the value of standardization. Implementation of serotherapy as model of modern drug regulation in France and Germany, 1894-1900*

Serotherapy was developed as a treatment against diphtheria between 1890 and 1894 in Berlin and in Paris. The treatment for a widespread disease that issued from innovative research in microbiology represented both one of the first industrially produced pharmaceutical products as well as a challenge for the existing regulatory processes. Pharmacists were not in a position to certify the purity and concentration of the drugs, and at this time there was no administrative procedure in place for the monitoring of industrial manufacturing either. The evaluation that Ehrlich developed in Germany and that in an altered form came into use on the other side of the Rhine, was intended to solve these problems. In Germany it combined the control of an industrial process along with a state guarantee of therapeutic validity. In France on the other hand the production and supervision of the antitoxin was first left to science and organized corporatively. The established standardizing procedures anticipated the central aspect of modern drug regulation. Their comparison demonstrates the technologies of trust with which the introduction of standardization into medicine negotiated therapeutic as well as moral values.

**Bruce Hevly**, University of Washington

*Taking Aim at Physics: The Ballistic Pendulum, Physics Concepts and Rifle Marksmanship*

This paper reports on part of a project to examine the target rifle as a mediating machine in the late nineteenth and early twentieth-century United States. Rifle ranges, as well-defined spaces characterized by social and physical discipline, peculiar technologies (including targets, marking and scoring systems, and the rifles themselves), and specialized practices, became associated with conceptual products reflecting these features. For example, the rifle appears as a central metaphor in Balfour Stewart’s 1874 treatise on the conservation of energy, which came out just as an American target shooting culture was being defined by the National Rifle Association at its new Creedmoor Range on Long Island. Here I argue that some of the ideas instantiated in target shooting -- promoted by the New York Times as a suitable national sport for the United States -- carried over into the main ideas advanced as a part of physics education in the US, via one artifact in particular: the ballistic pendulum. Described by Benjamin Robins in a 1742 publication, by the end of the nineteenth century the instrument had undergone a change in associations, from gunnery to laboratory demonstration. The meanings associated with it can be understood in part by reference to the significance of a new marksmanship culture in the United States, particularly one associated with student shooters.

**Danian Hu**, The City College of New York

*One Doctrine, Two Different Consequences: the contentions of relativity in China and the Soviet Union*

I have pointed out elsewhere that the criticism of relativity and Einstein in China began to emerge under the influence of dialectical materialism imported from the Soviet Union during the 1950s. That Marxist doctrine, mutually shared by many in both the U.S.S.R. and the P.R.C., however, led to two opposite developments in the 1960s. Whereas radical Chinese ideologues sponsored organized campaigns against relativity during the Cultural Revolution (1966-1976), Soviet philosophers not only “withdrew their earlier accusations against Einstein” but also “tried to demonstrate the essential affinity of Einstein’s theories with Marxist ideology.” In this paper, I would like to compare the apparently dichotomous fates of relativity in these two Communist countries and explore the nature of the events.

**Patti Hunter**, Westmont College

*Gertrude Cox in Africa: A Case Study in Science Patronage and International Statistics Education in the Cold War*

Gertrude M. Cox (1900-1978), first chair of North Carolina State University’s Department of Experimental Statistics, worked in the 1960s to establish university statistics training programs in Africa and the Middle East. As a member of the governing board of the International Statistical Institute (ISI), she led that organization’s efforts to supply universities in so-called developing countries with prominent statisticians who could advise the universities as they created their own programs. Cox obtained some of the financial resources for these efforts from the United Nations, from agencies of the United States government, and from major American philanthropic foundations such as Ford and Rockefeller, each of which had its own agendas. This talk will provide examples of transnational scientific exchanges that had as their specific goal the strengthening of particular national scientific communities, but which occurred in the context of other national and international agendas – in particular, the Cold War foreign policy of the United States and the UN’s efforts to address issues of economic development. The talk will argue that while the strategy of tying their goals to these other agendas enabled statisticians to obtain some resources for their efforts to strengthen their professional communities, it also limited their success by forcing them to take into account interests that competed with, or at least stood in tension with their own

**J. Benjamin Hurlbut**, Harvard University

*Confusing Deliberation: what “cloning” means for democracy*

This paper will examine some American efforts to shift the terminology of public deliberations over human cloning away from the term “cloning.” While proponents of these terminological shifts have generally argued that a chief virtue of their favored terms is truth-to-nature, this paper will examine a subset which have sought further justification through reference to democratic norms. Terminological accuracy is essential, proponents have maintained, for fostering robust democratic deliberation over those matters which properly belong to the non-expert public: the social, the religious and the ethical. Proponents of these approaches have attempted to take what they see as inappropriately politicized objects (such as the SCNT-derived stem cell) out of politics so that they can reenter in a newly stabilized and uncontested way. In this way the traditional gatekeepers of fact also claim the role of guardians of democratic deliberation, or at least of the conditions for the possibility of it. These efforts to structure public discourse have been described as efforts to mitigate confusion and to control for ideological biases preexisting in the public understanding of the relevant science, thus expanding rather than narrowing the conceptual space for democratic dialogue. This paper will examine some of the contexts in which these custodial duties have been described and undertaken.

**Joel Isaac**, University of London

*The Ecumenical Moment: Philosophy of Science, Scientific Philosophy, and Philosophical Science in Interwar America*

The discipline of the philosophy of science can today claim a catholic range of interests and an impressive degree of technical sophistication. Philosophers of science concern themselves with fields as diverse as biology, mathematical logic, and the social sciences, and they bring to bear in their researches an impressive array of analytical tools. Strikingly, however, the philosophy of science is no longer an enterprise to which most non-philosophers – even those whose disciplines are the subject of philosophical thematization – feel competent to contribute. This situation stands in stark contrast to the epoch between the two World Wars, when the productive ferment both of philosophy and of the special sciences in the United States encouraged a remarkable set of social scientists, linguists, psychologists, natural scientists, and philosophers to carry on a multidisciplinary discussion about the nature of scientific knowledge, human understanding, and the unity (or disunity) of the sciences. In this paper, I assess one key node in this ecumenical interwar discourse on the philosophy of science, and offer some explanations for its emergence. My subject is the peculiar intellectual culture of Harvard University in the 1920s and 1930s. I shall discuss the key venues where exponents of various disciplines came to exchange views and formulate treatises on knowledge-making in the sciences. Among the representative texts I shall examine are Lawrence Joseph Henderson’s *Pareto’s General Sociology* (1935), Talcott Parsons’s *The Structure of Social Action* (1937), and Susanne Langer’s *Philosophy in a New Key* (1932).

**Kenji Ito**, The Graduate University for Advanced Studies (Sokendai)

*Pedagogical Structure and Failure of Knowledge Transmission: Marginalization of the History of Science in Japan*

Development of a certain discipline in, or its dissemination to, a given national context depends on various factors. One of them is pedagogical: the national education system affects development of a discipline at least in two ways. First, training of new generations of researchers depends on the educational system; second, academic employment possibilities of young researchers are largely determined by the system of higher education. The present paper aims to illuminate some aspects of transmission of a scientific discipline, or its failure, in the case of the history of science in Japan, by focusing on some characteristics of its educational structure. One might notice that Japanese scholars’ contribution to the international community of the history of science and technology has been less than expected considering, for example, the overall success of Japanese science and technology. There have been several historians of science trained overseas who attempted to establish the history of science in Japan, but their efforts have not yet turned out very fruitful. This issue appears even more puzzling because Japan has a relatively long tradition of the history of science, starting in the 1930s. This paper attempts to solve this question by analyzing the Japanese system of education, mainly higher education. In addition to continuous problems since the Meiji Restoration for humanities in general, I claim that various educational reforms implemented after World War II left little room for the history of science to develop as a discipline in Japan.

**H. M. Iftekhar Jaim**, Bangladesh University of Engineering and Technology

*Indian War Rocket: A World Class Technology by Local Artisans*

The stunning success of the British during the Napoleonic War and the War against US (1812-14) was led by the Congreve Rocket, a British military weapon. The admiration of this rocket is lucidly articulated in the U.S. national anthem: “the rockets’ red glare, the bombs bursting in air.” According to rocket historians including Willy Ley, F. H. Winter and John H. Lienhard, Congreve Rocket was rooted back by solid propelled rocket weapon of Tipu Sultan, ruler of the Kingdom of Mysore, India. As remarked by Roddam Narasimha in *Nature* (Volume 400 Number 6740 pp 123) these Indian rockets made by the craftsmen were considered to be the best rockets in the world. Interestingly, the success of the rockets lies in the designing and superb metallurgical skills of the artisans. However, the production of rockets came to an end for the global impacts of the industrial revolution and British colonial rule. And this technology became extinct due to the non-scientific approach and caste based social system of the artisans. Therefore, this paper is to bring out some salient features of the socio-economic and some other perspectives of the local artisans that led to development, nourishment and finally eradication of this advanced technology. Besides, the research will also inquire on the geographical factors that gave rise to the necessity of such war rocket in that politically vulnerable region.

**Vladimir Jankovic**, University of Manchester

*Climatological Citizenship: The Many Lives of a Modern Fetish*

Historians have often argued that the origins of modern environmental thinking can be traced back to the “saddle period” in Western history (ca. 1750) during which time the European and American publics acquiesced to the view that political theorizing, social action and national characterology ought in some measure to draw upon environmental factors. At this time, European and American societies promoted themselves into “socio-climatological polities” by granting their subjects rights which they could invoke in situations in which their livelihoods suffered from external stress (disease, pollution, industrialization, disasters, poor hygiene, urban infrastructure). The paper will outline the causal attribution that informed this “triumph of environmentalism” (Olson, 2003) in the eighteenth-century human sciences. It will explore the reasoning behind the idea that civic identity and governmental responsibility ought to be related to the contingency of soil, water and climate. One of the questions will ask how the nineteenth century European states and US defined their welfare agendas around projects such as climate monitoring, weather modification, public health engineering, pollution control, climatotherapy, climatic labor-migration, and management of small-scale airs. I will suggest that in their attempts to render their subjects immune to environmental contingency, modern states have elevated climate into a “fetish” which occurs when “the mind ceases to realize that it has itself created the outward images or things to which subsequently it posits itself as in some sort of subservient relation” (Simpson, 1982).

**E. Jesse**, Montana State University, Bozeman

*“The Greatest Laboratory Experiment of History”: Operation Crossroads, Bikini Atoll, and the Geography of Science during the Early-Postwar Period*

On the advent of nuclear weapons testing by the United States in 1946, scientists within the Atomic Energy Commission perceived that the greatest risk to the public from fallout came from direct and external bodily exposure to gamma radiation. Since the dose from external forms of radiation produced during nuclear weapons tests seemed relatively small and amenable to the control of scientists charged with radiation safety, the dangers from nuclear weapons testing appeared negligible. Yet as mounting evidence began to accumulate pointing to the complex interaction of specific weapons-produced radionuclides and human health, scientists became concerned with the role of the environment in mediating exposure to human bodies. By the late 1950s, scientists began to understand the body/environment interaction in nascent ecological terms: the pathways through which radiation could enter the body were manifold, complex, indirect, and tortuous. Ingestion of radioactive material that migrated and bioaccumulated through the food chain, either through root uptake in plants or via foraging animals, became the primary source of concern rather than exposure to external radiation. This emerging ecological framework enabled scientists to see the ways that substantial quantities of radiation could enter the body. Faced with such complexity and the concomitant rethinking of the risks associated with nuclear weapons testing, the AEC in the mid-1960s began to spend considerable energy and funding on ecosystems ecology to rationalize and thus better manage the interaction between these complex radioactive environments and human bodies.

**David Jones**, Massachusetts Institute of Technology

*Representation and Intervention: Visualizing the Pathogenesis of Myocardial Infarction, 1970-1990*

By 1960 coronary artery disease (CAD) caused one-third of all deaths in the United States. Its ascent left physicians in an embarrassing position: decades of research had not provided a definitive explanation of heart attacks, CAD’s most dreaded complication. The most basic question, whether coronary thrombi were the cause or consequence of myocardial infarction, remained contested. Since autopsies were confounded by changes that took place between infarction and death, researchers needed to study the events inside living arteries that transformed chronic atherosclerosis into acute infarction. To do so, cardiologists and engineers adapted technologies as varied as angiography, radioisotopes, MRI, and intravascular angioscopy, ultrasound, and thermal imaging. The proliferation of imaging modalities between 1970 and 1990 deepened uncertainty. The problem was not simply assessing the objectivity of a technique. Because of the near impossibility of actually observing the moment of infarction, researchers had to determine which modality provided the most informative representation of relevant proxies of infarction. The ensuing multiplicity of practices and representations did not co-exist peacefully, each within a bounded discipline. Instead, they were contested actively by pathologists, radiologists, cardiologists, and surgeons. At stake were the massive resources allocated for prevention and treatment of the nation’s leading cause of death. The etiologic debates generated many treatments, from bypass surgery to angioplasty, thrombolysis, and cholesterol reduction. The outcomes of each of these interventions, in turn, generated new knowledge about what the underlying pathophysiology might be. Therapeutic practice thus produced yet another mode of representation of the puzzles of CAD.

**Kathleen Jones**, Virginia Tech

*“Unnatural and Monstrous”: Creating “Child Suicide” in the Nineteenth Century*

Suicide did heavy cultural work in the nineteenth century, helping to sort and prioritize nations, races, religions, genders, and ages. The association of the highest rates of suicide with industrialized trans-Atlantic cultures (with “civilization”) gave pause to Euro-American claims of moral and social superiority, but a diagnosis of psychic fatigue helped to adjust statistics to preconceived notions of social hierarchy. The child, too, carried a heavy cultural burden. The locus of innocence and purity, the child was also a “savage,” in need of education and discipline. The status and treatment accorded the child was a marker of civilization and contributed to judgments about social hierarchy. Incidents of child suicide, in contrast, challenged notions of both adulthood and civilization. I will examine how the perplexing incidents of child suicide were incorporated into a social Darwinian universe. Suicide experts, psychiatric practitioners, and child developmentalists defined child suicide as “rarity,” with “trivial” motives. The child who did not commit suicide was acting childlike, but, ironically, so was the child suicide. The immaturity of the child’s mind accounted for those few children who died by their own hands. By the end of the nineteenth century, child and adult suicide had been effectively separated as two distinct social problems, with suicide a privilege of adulthood. Differentiating by age is part of a pattern of specialization in medical science; by examining the construction of child suicide, this paper points to the significance of age for our understanding of late nineteenth-century scientific thought.

**Matthew Jones**, Columbia University

*Formalism and its Discontents: The Danger of Frivolous Mathematics in the Mid-Enlightenment*

For all their advocacy of mathematics, enlightenment savants worried precisely about the epistemological and moral dangers should mathematics become too disconnected from the real world. In the Enlightenment, mathematics at once exemplified proper knowledge and baroque play. Certain? Yes. Amusing? To be sure. Instructing? Not always. To many critics, such as Denis Diderot or Daniel Bernoulli, formal linguistic procedures – despite their certainty – too easily led mathematicians into an autonomous game, disconnected from the world and natural things, fit only for the speculation of barbarous pedants or devious tricksters, appropriate neither for civilizing nor educating. Bad mathematics was like bad language: it lacked reference and precluded knowledge. This paper uses the mid century dispute about solutions to the vibrating string problem to illuminate disputes about the role of formal language for enlightenment.

**Edward Jurkowitz**, Illinois Institute of Technology

*Planck's Unification of Physics within German Liberal Culture*

This paper presents a new interpretation of Max Planck's scientific research. By locating his efforts within the context of contemporaneous methodological discussions, I argue that Planck, following Hermann von Helmholtz, pursued an empiricist approach to framing physical laws and toward organizing science in general, one characteristic of German liberal scholars. Planck's research, from his earliest works onward, consistently expressed this methodology, while his discovery of the blackbody law resulted from consistently using it to explore the micro-world. In the final section I argue that Planck's research work expressed the essential characteristics of, and contributed to a wider stream of German scholarship, one running through legal studies and many Geisteswissenschaften and built around a particular strategy for achieving intellectual and cultural unity.

**Abdul Nassser Kaadan**, Aleppo University

*The Achievements of Albucasis in Neurosurgery*

Albucasis has lived in Andalus (Spain), and died there in 1013. He is considered one of the most celebrated surgeons during the Middle Ages. The influence of his book (*Kitab al-Tasrif*) in the field of surgery development in general and neurosurgery in particular was tremendous. Guy de Chauliac, the "restorer of Surgery" quotes Albucasis more than 200 times. The arrangement of the work, the clear diction, and lucid explanations, all contributed to its great success. It soon became an authority quoted by medieval European physicians and surgeons more frequently than Galen himself. Albucasis describes some neurosurgical operative procedures and instruments which do not appear in extant classical writings and which may be regarded as his own. In the chapter related to Hydrocephalus treatment, Albucasis says: "If the humidity is beneath the bone, and the sign of that is that you will see the sutures of the skull gaping on all sides, you should make three incisions in the middle of the head, in this pattern. After incising, drew out all the humidity, then bind up the incision with pads and bandages, and over the bandages foment with wine and oil till the fifth day" The aim of this paper is to shed light on Albucasis neurosurgery, to reveal his accomplishment and contribution in this field of surgery.

**Despina Kakoudaki**, American University

*Deep Frame: Picturing the Body in Early Cinema*

This paper focuses on the technological and epistemological implications of depicting the human body on film, by tracing modes and experiments from the first ten years of cinema. For inventors and artists of the era, the body functioned as both subject and site for negotiating and defining the capacities of this new medium. Close study of examples, from the first camera experiments of the 1880s to the first cinematic special effects in films made from 1900 to 1907, allows us to see that despite their general adherence to the legacies of photographic realism, early filmmakers also developed a rubric for a wider phenomenological investigation of film. In their work the two dimensional cinematic frame is often imagined as a deep space of infinite possibility, while the body is in contrast a spectral and often elusive entity that occasionally "bubbles up" from such imagined technological depths. These narrative and technological responses offer valuable insight for the ways in which new media, new technologies and new modes of visual representation affect and even define the limits of the real.

**Allison Kavey**, CUNY John Jay College

*"The Mistress of her own operation": The relationship between the divine and the natural and the potential for practitioners in Agrippa's cosmogony*

Heinrich Cornelius Agrippa von Nettesheim's *Three Books of Occult Philosophy* was printed for the first time in 1531. Over the next 150 years, it was reprinted in four languages and as many countries, and it is one of the few books from the early 16th century to have remained an important force in natural philosophy during the years of upheaval and intellectual reappraisal known as the Scientific Revolution. One of the reasons that Agrippa's book was so successful was its approach to natural philosophy, which flipped upside down traditional understandings of the relationship between the divine, the natural world to offer much more potential for practitioners to cause change in the world around them. This was part of a larger world-building exercise, in which the constructs of intelligence, passion, and knowledge played a crucial part. This paper will discuss the building blocks of Agrippa's world and describe the ways in which these pieces helped to place practitioners at the center of an elegant and powerful system of natural change that responded to their will, knowledge, passion, and imagination as defining forces.

**Vera Keller**, McGill University

*The Desiderata List: Collecting the Future in the Early Modern Past*

Several recent studies emphasize the desire for and commerce of objects as agents in the growth of empirical natural philosophy. I study the early modern bookkeeping techniques used to direct and control desire. In the proliferation and diversification of desiderata (wish) lists in the period, we see individuals explicitly framing the search for a future in terms of enumerated desires. The desiderata list offered both a rhetoric and a research tool for philosophers envisioning what they considered a radical reform of learning. According to a period association of status and reason, social superiors (and thus the rational) balanced the books, directing the insatiable avarice of men toward the advancement of new endeavors, while keeping the desires of the marketplace in check with competing lists of impossibilities. Economic theorists and natural philosophers alike such as Jakob Bornitz, Francis Bacon, Robert Boyle, William Petty, Samuel Hartlib, J. J. Becher, and G. W. Leibniz employed lists of deperdita (lost things), desiderata (wanted things), nova inventa (new inventions), and impossibilia (impossibilities) to organize socially differentiated programs of economic and philosophical reform. The most desirable objects were those liable to move unpredictably between the depths of folly and the heights of invention, and between lists of desiderata and those of impossibilia. Such lists show us the landscape of seventeenth century discovery as a quicksand of shifting knowledge covered with a haze of possible promise.

**Meegan Kennedy**, Florida State University

*Adulteration and the Microscope: The Limits of Revelation*

Popular and even professional Victorian texts on the microscope often lauded its powers in phrases that evoke sensational, nearly miraculous revelations. Other than forensic discourse, the field in which the microscope's abilities were most fervently applauded was probably that of food safety. Arthur Hill Hassall argued in 1857 that he had introduced the microscope in the study of food adulteration, "the most practical and important use which has ever been made of that instrument." The topic continued to hold readers' attention through the end of the century. This paper will examine the discourse of adulteration and its discovery in texts by both well-known and little-known Victorians (William Houghton, Edwin Lankester, Frank J. Wethered, J. H. Wythe, John MacDonald, and others). But these treatises on the microscope must present not only inspiring tales of revelation but also incessant cautions about the difficulties of using the instrument. As Jutta Schickore and others have shown, microscopists were well aware of the challenges to accurate vision, due to problems with human perception, the technological limitations of the microscope, and sheer human error. As a result, even the treatises that most fervently sing the praises of microscopes as a revelatory instrument also exhort their readers that the evidence of the microscope is never certain. Indeed, this paper will show that the arguments proposed by such treatises are inherently unstable: that these texts must uneasily negotiate the fact that the revelations made possible by the microscope are themselves "adulterated" and unreliable.

**Daniel Kennefick**, University of Arkansas

*"Not Only Because of Theory": Eddington and his theory testing bias in the 1919 eclipse expedition.*

Recent debates on the famous 1919 eclipse expedition to test Einstein's prediction of the bending of starlight have focused on the apparent bias of Arthur Stanley Eddington, one of the leaders of the expedition. Eddington allegedly schemed to confirm Einstein's prediction over the so-called "Newtonian" prediction. My talk looks at two aspects of this issue. First, I will show that the other leader of the expedition, Frank Watson Dyson, made many of the key data analyses but did not share Eddington's apparent bias. Modern re-analysis of the expedition's plates seems to justify Dyson's decisions as scientifically appropriate. Second, I will examine why Eddington was biased in favor of Einstein's general relativity, leading to his eagerness to frame the observations as a test between the new theory against the old Newtonian theory. As John Earman and Clark Glymour have noted, it was historically dubious to label one of the two predictions "Newtonian" since it too was made by Einstein. They argue that Eddington framed the theory testing in such a way as to dramatise his preferred narrative of a triumph of general relativity over Newtonian gravity. So it is of interest to discuss what Eddington's motivations tell us about the circumstances in which the reception of general relativity occurred.

**Randy Kidd**, Bradley University

*"Language of the Heart: The Mingling of Metaphoric and Literal References to the Heart and Blood in the Writings of Harvey and His Contemporaries"*

This paper analyzes the impact that Harvey and some of The Oxford Group's findings with respect to the nature of the heart and blood, had on language. We still speak of "knowing something by heart," "living with one's heart" and "believing with one's heart". Given the discoveries of the circulation and the compound nature of blood, one might expect that language would more closely parallel our physiological knowledge. This paper focuses primarily upon the writings of 17th century natural philosophers-- some working within the mechanistic world-picture, some whose philosophy more closely paralleled Harvey's own "vitalism"-- and argues that we find a surprising mingling of literal and metaphoric heart and blood references, sometimes in the span of a single paragraph. By looking at citations from Harvey, Boyle, Locke, Lower (and some biblical and classical references for context) we will see that one of the ways we integrated the new knowledge about the heart and blood was by moving, when speaking about our bodies, in and out of metaphor; this allowed Early Modern thinkers to accommodate the new physiology to longstanding views about the centrality of the heart and blood. This practice of mingling the literal and metaphoric with respect to our hearts and blood, persists in powerful ways.

**Yoshiyuki Kikuchi**, Sokendai, The Graduate Institute for Advanced Studies

Chemical Heritage Foundation, *Anglo-Japanese Chemistry Contacts in Action: The English Model of Chemical Education in Meiji Japan*

Japan underwent a process of institutionalization of scientific and technological education in many fields during the Meiji period (1868-1912) as a part of its industrialization process. The key persons in this process were hired foreigners and overseas students, and in the particular case of chemistry and the chemical industry they were either English chemists working in Japan or their Japanese students and successors who completed their studies in England. The following questions need to be considered: 1) did their experiences in England help to shape their ideas of how to teach chemistry at the higher level and how to organize and run chemical research laboratories? 2) If so, how and by what mechanisms did they translate, select, modify and reconfigure this "English model"? 3) How did intercultural personal relationships between British chemists and their Japanese students affect the above "transfer" process? To answer these questions, I elaborate the concept of "transculturation" in "contact zones" in Mary Louise Pratt, *Imperial Eyes: Travel Writing and Transculturation* (London: Routledge, 1992) by drawing on recent sociological studies on classroom dynamics in pedagogy and intercultural communication in multinational workplaces, and my own case study on the structures and dynamics of contact zones such as classrooms, laboratories, and other socializing spaces where intercultural communication between English chemists and their Japanese students took place. I argue that the people at the heart of the structure of contact zones, who are often not senior professors but junior assistants, are decisive factors in Anglo-Japanese bilateral transfer of educational models.

**Mi Gyung Kim**, North Carolina State University

*The Balloon Spectator*

When the Montgolfier brothers' balloon ascension caused a "fermentation" in the public sphere, the *Journal de Paris* became the central clearing house for the balloon news. It suppressed much of the vulgar enthusiasm and curiosity to present the balloon ascension as a scientific experiment rather than a marvelous spectacle. The public identity of this material actor and its theatrical relation with mass spectators had to be carefully monitored and scripted to circumscribe its moral, civic and political meaning. Inscripting the balloon spectacle/experiment required imagining and disciplining the attitude and the behavior of present and future spectators. To this end, the *Journal* co-opted the textual figure of the spectator that had been shaped in opposition to the theatrical polity of the ancien regime to configure the balloon spectator as a rational observer of the spectacle/experiment with disciplined curiosity on its scientific performance and with aesthetic appreciation of the scenery it uncovered. The strong consensus in the "public transcript" on ballooning, expressed in numeral and cartographic precision, indicates the tight control the scientific and administrative elites pursued on this subject and the potential danger they perceived should such a control of popular opinion and the crowd fail.

**Joel Klein**, Indiana University

*Thomas Willis's Experimental Chemical Anatomy*

Thomas Willis (1621-1675), the Oxonian physician, has been primarily understood within the context of the history of medicine and anatomy, and while his major discoveries are aptly categorized under those rubrics, his earliest publications and interests were in chymistry. In fact, many of his later ideas cannot be fully understood unless we consider them in this chymical context. Willis explained most actions in the natural world according to various fermentations, which themselves are explicable according to five fundamental, chymical principles – spirit, sulphur, salt, water, and earth – which are naturally those principle substances revealed to the senses by distillation. The use of this “sensible-chymical” analytical method places Willis in a long tradition of chymists and alchemists that stretches back to the Middle Ages, and similarly, it demonstrates a commitment to a quasi-Baconian empiricism. Moreover, it is clear from correspondence in the mid-1650s that Willis enjoyed some form of professional relationship with the prominent Oxford chymist, Robert Boyle (1627-1691). Upon comparison of their works, several aspects of Willis's experimental program appear strikingly similar to Boyle's. For instance, in the second edition of Willis's first publication, *Diatribae Duae Medico-Philosophicae* (1660), Willis discussed several redintegration experiments which are very similar to those Boyle detailed in later publications. While Boyle used these experiments to argue for a more mechanistic conception of matter, Willis used them to support his alternative system of the five fundamental, chymical principles.

**Judy Klein**, Mary Baldwin College

*The Cold War Modeling Nexus of Economics, Operations Research, and Control Engineering at the Carnegie Institute of Technology*

Starting in 1950 the United States Air Force Project SCOOP (Scientific Computation of Optimum Programs) and the Office of Naval Research awarded contracts to establish and maintain a research center for the Planning and Control of Industrial Operations at the Graduate School of Industrial Administration of the Carnegie Institute of Technology in Pittsburgh. The center brought together professors and graduate students from control engineering, business administration, and economics for formalization and quantification of rules of action amenable to electronic computation for logistics, production smoothing and inventory control in firms and military units. The terms of the contract were such that the researchers experimented with their models and computer algorithms on the Philadelphia Gulf Oil Refinery and the Pittsburgh Plate Glass Company after which they perfected their models for reports to the military and further generalized their formulations for publications in academic journals such as *Econometrica*. The military projects initiated a research strategy that the participants called “applications driven theory.” This strategy generated new optimization techniques (including modeling computable linear decision rules with quadratic criterion functions and modeling expectations with exponential smoothing), a reappraisal of what constituted management science, canonical theoretical articles on time series analysis, and novel concepts for three Nobel Prizes in Economics. Material from the archives of the GSIA at Carnegie Mellon University illuminates this military-industrial-academic complex engaged for over a decade in research on planning and control for the free-market side in the Cold War.

**Krister Knapp**, Washington University in St. Louis

*A Fact-in-Waiting: William James and Experimental Telepathy*

During the late nineteenth century a small group of transatlantic intellectuals at the British and American Societies for Psychical Research attempted to employ modern scientific method, statistics and the probability calculus to try to prove the soul survives bodily death. They investigated many topics, but their first and most thorough one was telepathy, or what they called “thought-transference.” If thought could be “transferred” from one living mind to the next (they reasoned), then it could be done between a terrestrial soul and one that had passed on to the “other world.” The SPR and ASPR employed a series of tests, such as card guessing, that sought to establish telepathy as a fact through the collection of large aggregates of outcomes occurring at rates higher than what random chance otherwise dictated. However, William James, a prominent member of both societies, while not denouncing that method, downplayed the importance of sample populations and instead emphasized the case-study approach. James believed that if a few, select individuals with a predilection for telepathy could be located, then a thorough testing of their abilities might yield better results than the aggregate approach. This paper compares these two methods in the context of the search to scientifically establish telepathy as a fact. It argues that while James's method ran counter to the success of the sample population one in the natural sciences, it demonstrated his commitment to proving telepathy through rigorous testing that adhered to valid experimental protocols without foregoing the subjective experience of individuals.

**Hylarie Kochiras**, University of North Carolina at Chapel Hill

*Gravity & Newton's Substance Counting Problem*

Can two things be in the same place at the same time? Newton thinks they might if they are substances of different kinds, and I argue that this is the reason that Newton cannot solve his problem about gravity's physical cause. His gravitational theory raises the spectre of matter acting at a distance, with sun and planets attracting one another across empty space. Since he considers unmediated action between material bodies absurd, he hopes to discover some immaterial substance, such as an aether, that might fill space and possess active powers to produce gravitational attraction. Yet any effort to locate such a medium or to associate active properties with it rather than with matter founders upon what I call ‘Newton's ‘Substance Counting Problem’’. If an immaterial substance could co-occupy the places occupied by material bodies, then we cannot use material bodies to try to confine the substance. Thus we cannot determine how many substances are present in a given location – the Substance Counting Problem – and if we knew how many substances were present, we would have no basis for associating active powers with the immaterial substance rather than with matter.

**Alexei Kojevnikov**, University of British Columbia

*“More is Different, “ or “the transition from quantity to quality”*

From his early years as a historian of science, Spencer Weart paid special attention to those aspects of modern physics which, however huge and important, are not the most publicly visible. In “Out of the Crystal Maze” and several related publications, he analyzed the professional physics community's largest segment, scientists working in the fields of solid state, condensed matter, or material science. In oral history projects and in cataloguing archival sources for the history of physics, he insisted on making these endeavors as truly international as possible, defying the usual Anglo-centrist focus and extending the scope to include, in particular, sources related to Soviet physics. This paper will discuss how such uncommon broadening of historical analysis actually changes our understanding of what the overall business of physics was and has become in the course of the twentieth century.

**Richard Kremer**, Dartmouth College

*Reading Artifacts: On Teaching with Historic Scientific Instruments*

In a pedagogical and scholarly world that privileges texts, how might we introduce students to the material objects of earlier sciences? What types of stories might such artifacts tell us about the history of science, its pedagogical and laboratory practices, its values and ethics, its relations to commercial instrument makers and other technologies, and its links to earlier cultures of design, materials, and craft? I will introduce a research and writing seminar that I developed with David Pantalony, in which students explore these issues with objects from Dartmouth's King Collection of Historic Scientific Instruments and some concepts for analyzing material culture developed by the Winterthur Museum. In addition to working with individual instruments, the students develop, research and install a small exhibit around a theme of their own choosing. This year's exhibit, "Colonel Mustard in the Library with a Galvanometer: Finding Clues in Historic Scientific Instruments," used the framework of the 1949 Parker Brothers board game to help visitors "learn to look" at unfamiliar objects.

**Ulrich Krohs**, University of Hamburg

*The Roots of Organismic Thinking in Systems Biology*

Genomics, the paradigm of data-rich biology, is generally regarded as a reductionistic (and by many also as a simplistic) research program. Systems biology relies on the high throughput methods developed within genomics and other omic disciplines, but claims to overcome the reductionism of these disciplines by bringing back the organism into data-rich biology. My paper asks for the sources of the organismic perspective of systems biology and for the changes that organismic thinking underwent. Systems biology has roots not only in genomics, but also in research programs that flourished in the mid of the 20th century, like biological cybernetics and pathway modeling. Several concepts of organismic wholeness were developed within those research programs. It turns out that systems biology does not yet fully incorporate any of the earlier concepts of wholeness. Simplified and ad hoc concepts prevail in the research papers of the new field. While some achievements of the older research programs like modeling techniques were adopted by the new field, the tradition of organismic thinking seems to be interrupted. The new, simple concepts of wholeness do nevertheless have their place within systems biology. I shall inquire whether this reflects a deficiency of systems biology or rather a changed notion of holism in comparison to older research programs. I shall also discuss recent attempts of bridging the interrupted tradition by integrating approaches to organismic wholeness that were developed the 1970ies into systems biology.

**Gary Kroll**, SUNY Plattsburgh

*Cultivating a Sense of Wonder: William Beebe, Rachel Carson and 20th Century Oceanic Natural History*

The history of traffic engineers offers much promise for bringing together environmental history and the history of science and technology. Moreover, the topic provides a strong crowbar into the complicated relationship between the modernist vision of the state (attempting to enhance friction-free movement of people and products) and the wider American public (with its creative ability to challenge and destroy those systems of control). Between the two stands the traffic engineer who responds to the "traffic accident" by using the power of science and technology to re-engineer environments to restore the order and flow of safe and speedy movement. This paper will demonstrate the value of this approach through an examination of the efforts to rationalize harbor traffic on the New York/New Jersey waterfront between 1880 and the establishment of the Port Authority in 1921. Between that those years, New York City's status as an entropot and the modernization of the merchant fleet stressed the port's ability to deal with the increased volume and speed of the traffic. New York, New Jersey, and federal engineers thus reshaped the environment and traffic systems to restore order--until the next accident, at least.

**Julia Kursell**, Max Planck Institute for the History of Science, Berlin

*Tracing Beauty: A Pianist's Collection of Fingerprints in Experimental Psychology around 1900*

Pianist Marie Jaëll has left a strange heritage to posterity: a huge collection of fingerprints taken from pianists as they played. Some famous personalities such as Albert Schweitzer who took piano lessons with Jaëll or Elisabeth Caland, one of the leading Pedagogues of her time, but mostly Jaëll herself and a great number of pupils left their traces on Jaëll's paper keyboards. Jaëll was obsessed by the question of why the most beautiful sound in the playing of a pianist like Franz Liszt also seemed to be the most natural movement. She decided to explore the laws of a physiology of beauty. After extensive readings of French and German philosophy and science she published a manual on piano touch. Charles Féré took notice of this publication and invited Jaëll into his laboratory at the Paris hospital Bicetre, which was then headed by Féré. From this encounter resulted a collaboration that was to continue until Féré's death in 1907 and that brought forth a number of common publications in scientific journals. This presentation aims to reconstruct their common experimental work. I suggest that Jaëll uses her finger print collection as literally indexical signs of sonorous beauty and correct movement. I will discuss, on the one hand, how these signs were supposed to relate to piano playing as a complex situation and, on the other hand, what experimental psychology expected from piano playing as an object of study.

**Cornelia Lambert**, University of Oklahoma

*Empiricism and Empire: Robert Owen's Scotland in the Romantic Age*

Around 1800 Robert Owen (1771-1858) established an experimental community at his factory on the outskirts of Glasgow. At New Lanark workers lived in prescribed housing, worked in specially-designed factories, and sent their children to schools with particular curricula. This paper puts these and other social technologies employed at Robert Owen's New Lanark experiment (1816-1828) into the context of contemporary claims about the primitive nature of rural Scottish society, the vogue for travel to Scotland, and what Christopher Fox calls the "spectacle of science" common to the development of the human sciences. These elements support my claim that Owen's work should be interpreted in light of a Romantic strain of empiricism. As early supporter Joseph Smith wrote to Owen: "We must do all we can at this time to establish a community to enable us to say 'Come & see, Come & see!'"

**Roger Launius**, Smithsonian Institution, National Air and Space Museum

*Venus-Earth-Mars: Comparative Climatology and the Search for Life in the Solar System*

Both Venus and Mars have captured the human imagination during the twentieth century as possible abodes of life. Venus had long enchanted humans – all the more so after astronomers realized it was shrouded in a mysterious cloak of clouds permanently hiding the surface from view. It was also the closest planet to Earth, with nearly the same size and surface gravity. These attributes brought myriad speculations about the nature of Venus, its climate, and the possibility of life existing there in some form. Mars also harbored interest as a place where life had or might still exist. Seasonal changes on Mars were interpreted as due to the possible spread and retreat of ice caps and lichen-like vegetation. A core element of this belief rested with the climatology of these two planets, as observed by astronomers, but these ideas were significantly altered, if not dashed during the space age. Missions to Venus and Mars, revealed strikingly different worlds. The high temperatures and pressures found on Venus supported a “runaway greenhouse theory,” and Mars harbored an apparently lifeless landscape similar to the surface of the Moon. While hopes for Venus as an abode of life ended, the search for evidence of past life on Mars, possibly microbial, remains a central theme in space exploration. This survey explores the evolution of thinking about the climates of Venus and Mars as life-support systems, in comparison to Earth.

**Chia-Hua Lee**, The University of Tokyo

*Beyond Changing Symbols: The Transmission of the Calculus to China and Japan in the Nineteenth Century*

The calculus was introduced as a new branch of Western mathematics to both China and Japan in the second half of the nineteenth century. This paper addresses the differences in the process of transmission through the lens of similarity and dissimilarity. It is within this process that a triangular relationship between the West, China and Japan developed, particularly via the circulation of books. Moreover, a close connection between China and Japan was built through the usage and the making of translations and textbooks on the calculus. In order to show how this subject was studied and how translated works were circulated and reproduced, the mistakes and corrections of textbook contents are considered, including changes in symbols and terminologies, and the use of reference sources available in China and Japan are investigated. In addition, on the related issue of participation, I analyze how and why specific groups of intellectuals, the assistance of Westerners, institutions and their instruction, and governmental policies were involved in the transmission and dissemination of the calculus. Finally, this paper attempts to answer the question of changes by looking at the transformation of mathematical symbols in these texts. Particularly, in addition to the changes made to symbols which were first transformed from Western style into an unique formula in Chinese translations but eventually revised back to their original form in Japanese texts, I discuss what changes have occurred in mathematical content in relation to previous mathematical traditions, the attitude of scholars toward the calculus, and the purpose of introducing this mathematical subject.

**Don Leggett**, John W. Kluge Center, Library of Congress/University of Kent

*Our “doubts” in fact appear to me as sacred”: William Froude, test tanks and Victorian doubt*

In 1871 William Froude built an experimental test tank: a laboratory for the study of hydrodynamics. It was paid for by the British Admiralty, and shaped the ships of the empire and the study of hydrodynamics for the remainder of the nineteenth-century. Utilising recent scholarship on “object histories” I explore the culture and concerns embodied in this technological system of modelling machinery and precision measuring instruments. I locate Froude, an “experimental mathematician,” in a social network of Victorian intellectuals with James Anthony Froude and John Newman, and the scientists William Thomson (Lord Kelvin), W.J. Macquorn Rankine and Charles Lyell. I then use Froude’s correspondence to explore his test tank technology as a response to the intellectual and spiritual crises of faith (Victorian Doubt) suffered broadly by Victorians and specifically by his social network of intellectuals and engineers. This approach to naval architecture challenges the predominantly deterministic framework through which the subject of ships and their design have been traditionally viewed. I investigate how Froude’s “mechanical” treatment of hydrodynamics resonated with the work of physicists and engineers on thermodynamics, and the broader Victorian vocabulary of mechanical thought. And I use Froude’s correspondence with Newman, the leader of the Oxford Movement and later a convert to Roman Catholicism, to compare how theologians and scientists responded to doubt, dogma, knowledge and religion. By locating naval architecture in a host of scientific and cultural contexts it is possible to contextualise the production of “trustworthy” scientific knowledge in the British navy.

**Rebecca Lemov**, Harvard University

*Database of Dreams: Toward A Postwar American Science of Subjectivity*

Whereas social science surveyors in the nineteenth and early twentieth centuries concentrated on gathering records of the material aspects of culture and society (tools, ritual objects, rites of passage, decorative items), mid-century modernists turned their efforts to attempt to collect the fleeting and insubstantial: people’s dreams, hopes, fears, evanescent desires, states of madness, and inchoate beliefs. Researchers turned to collect the stuff of subjectivity, as manifested or materialized in psychological test results, life histories, and records of jokes, invective, and strong sentiments. Among various efforts in the 1940s and 1950s to collect, catalog, and store – in short, to file – those parts of human inner life most resistant to being so treated, none was more ambitious than the “Database of Dreams” assembled in 1956. Funded by the National Research Council, run by a cadre of psychologists and anthropologists, and accessing decades of ethnographic and documentary research, “Primary Records in Culture and Personality” attempted to map the scope of all such collections, and to write a strategy for preserving and circulating them. This pre-digital, Microform-based encyclopedic device played a part in the movement to found a postwar American science of subjectivity, pursued through objectivist methods. The aim of this paper is to reassess the early Cold War human sciences’ twin pursuit of “innerness” and of masses of data. How did this approach to the “challenge of data” contribute to an interweaving of minds and machines that only accelerates today?

**Deborah Levine**, Washington University in St. Louis

*Marketing Measurement: Anthropometric Technologies in the American Marketplace*

The numbers that a bathroom scale displays, though conceivably nothing more than an abstracted and invisible reference point, have come to signify something specific about the identity of the person on the scale. When did this begin? When did one's weight become a significant thing to know about oneself, and what was the impetus behind people beginning to weigh themselves in the first place? The answers to these questions reveal a co-production of medical measurement and its marketing by scale companies, physicians, and life insurance executives. In this paper I trace the technological innovations and the history of the meaning of a person's weight from the mid-nineteenth century, when an average adult would likely not have had any idea of their exact weight, and follow these developments to the turn of the twentieth century, when the number of pounds a person weighed would have been a common piece of individual knowledge for nearly all adults in the United States. This project examines the myriad anthropometric technologies employed by physicians and their patients to weigh the body and thereby construe a determination about health in the late nineteenth and early twentieth centuries. Focusing especially on the history of one such technology, the bathroom scale, my aim is to explore the role of the medical marketplace in the historical linking between maintaining "normal" weight and health that began to take hold in the late 19th and early 20th centuries. .

**Philip Loring**, Harvard University

*From Johnny to Chomsky*

The controversial 1955 bestseller *Why Johnny Can't Read* warned Americans that their children were slipping behind. Wedded to psychological research that approached reading as a process of word-recognition, textbooks introduced a limited number of new words each school year, and teachers seldom prompted students to "sound out" unfamiliar words from their spelling. This effectively limited students' reading repertoire to the dull distillations found in the textbooks. As an alternative, *Why Johnny Can't Read* advocated "phonics," an approach informed less by psychology than by linguistics. Phonics focused on the sounds of letters and promised children the ability to decode unfamiliar words and thus read independently sooner. Celebrated in the popular press yet roundly criticized by educators and psychologists, the book nonetheless found a welcome reception among American linguists, who were eager to leverage Cold War concerns into a more prominent role for their own special sort of scientific expertise. This paper examines how a work of popularization like *Why Johnny Can't Read* affected debates within linguistics in the late 1950s, at the time when a young linguist named Chomsky began to shake up the profession. Situating Chomsky's early work in the context of the phonics debates allows us to chart intersections between expert and political discourses on proper English, and reframes the significance of the Chomskyan revolution in the history of the Cold War human sciences.

**Paul Lucier**, Independent Scholar

*Mining Science and Mining Law on the Comstock Lode*

In 1865, Nevada tried to appoint a State Geologist. According to a western newspaper, the geologist's duties would include: 1. Calculating all eclipses of the sun and moon; 2. Foretelling cloudbursts; 3. Guarding against "irruptions" of grasshoppers; and 4. Discovering earthquakes, book-agents, erysipelas, and corn doctors and providing suitable means to exterminate. Western miners generally did not have very exalted opinions of geologists. But at the Comstock in the 1860s, those opinions changed, especially among capitalists and companies who ran the mines. The reasons had as much to do with the "nature" of the ore -- it was difficult to find -- as it did with the people who wanted to find it. Mining could be done on one's own property or on one's neighbor's, depending on whose vein was richer and on who had the better legal team. The Comstock was thus as famous for its silver -- the West's largest lode -- as for its endless litigation over who owned what. Geologists were central to both claims to fame. This paper will present the first analysis of the great battles over "courtroom geology" from the perspective of the scientific experts. It will show how important such court cases were to the development of theories about the origin of metallic ores as well as to the codification in 1874 of the US Mining Statutes and the infamous Apex Law, which allowed the owner of the surface outcrop of a mineral vein to follow that vein anywhere it went, including across a neighbor's claim.

**Michael Lynn**, Agnes Scott College

*Controlling Spectacle and the Policing of Aeronautics in Europe at the End of the Eighteenth Century*

Aeronautical experiments proved enormously popular much to the advantage of those using subscriptions to fund their work, but much to the chagrin of savants hoping to use balloons for scientific research. In either case, however, access to launches was very hard to control. Once the balloon reached a certain height, men and women from all social, economic, and educational backgrounds could witness the aeronautical experiments. This helps explain the importance of controlling access to the workshops where aeronauts manufactured their balloons as well as the desire of the local and state authorities to police the practice of ballooning. This paper will explore the myriad methods used to control access to launches (including fences, hiring guards, and keeping the location of launches a secret). In addition, I will analyze the reasons why different groups, including savants, state authorities, and balloonists, tried to set limits on who could attend launches and when it was acceptable to launch a balloon. Last, I will discuss the different attitudes of balloonists and others to the various social groups who viewed launches. Since the audience might perform the task of witnessing, help fund the launch, or, from the negative side, riot and destroy the balloon if the launch did not go as planned, the balloonists' relationship with his or her audience was a crucial and tense zone of scientific popularization.

**EunJeong Ma**, Cornell University

*What is "Colonial" about Colonial Medicine and Science?*

In contemporary Korea there exist two parallel medical systems with distinct educational, clinical, and administrative systems: Western biomedicine (WM) and Korean Oriental medicine (OM). In this paper I discuss the colonial origins of the co-existence of the two forms of medicine, with particular attention to intellectual debate over scientific medicine in the 1930s. I ask what is "colonial" about colonial medicine and science. In the late nineteenth century, the importation of WM took place through two major channels: Christian missionaries and Japanese colonial agents. During the colonial period (1910-1945), the Japanese imperial government used WM as a tool to colonize Korea and the Korean people by advocating that WM was scientific and modern as opposed to obsolete and pre-modern indigenous medicine, OM. It devalued the epistemic foundations and practices of OM and implanted "modern," "scientific" Western medical education in hospitals and public health policies. In the 1930s when the colonization of Korea was deepened, colonial elites began to reflect critically on the status of the modern knowledge that had been implanted by the Japanese empire. They explored the place and role of "West" and "science" in the construction of Western and Oriental medicine in Korea.

**Harro Maas**, University of Amsterdam

*Sorting Things Out: The economist as an armchair observer*

It is commonly held that (political) economists, from the days of Ricardo until well after the Second World War, were considered the kind of scientist who relied too much on observations contrived in the comfort of the armchair. Rather than joining the chorus of those who condemn and condemned this practice, this paper will trace its peculiarities back to the days when political economists first generalized the paradoxical experiences of an emerging market economy into explanatory principles. These generalisations were made by confronting conflicting observational reports from histories, travel journals, governmental reports, and personal experiences and observations, or by contrasting similar resources with fictional societies (utopias). Just like a cabinet naturalist arranged and organised specimens that were sent from all over the world, so did the political economist sort things out by comparing and rearranging the available evidence at his disposal. This was done in discussion with friends and colleagues, and in the confines of one's study. With field research and quantitative methods taking hold in the social sciences at the end of the nineteenth century, such stationary practices were looked at with growing suspicion from within the (social) science community. Once econometrics set the standards for empirical research in economics, a formerly ordinary observational practice came to be referred to as mere "armchair theorising".

**Geerd Magiels**, VUB Free University Brussels

*Why Did Nobody Ever Discover Photosynthesis? Dr IngenHousz and the discovery of photosynthesis*

Very few people know who discovered photosynthesis, the story of which spans two centuries. A pivotal role was played by Jan IngenHousz, whose name, life and works have been forgotten. The tale of his scientific endeavour shows science in action. It opens up an undisclosed chapter of the history of science and shines some light on the processes of the development of science. Jan IngenHousz (1730-1799) led a travelling life between Breda, Vienna, London, Paris, Milan and Bath. A medical doctor with broad scientific interest, IngenHousz was appointed as Imperial Physician after successfully inoculating Maria Theresia's family against smallpox. He befriended John Pringle, Joseph Priestley and Benjamin Franklin and kept close contacts with Lavoisier, Herschel, Van Swieten, Senebier and many others. He reported lucidly on 500 crucial experiments in his *Experiments upon vegetables*. Its publication in 1770 and subsequent articles, books and correspondence indicate him as the first to describe photosynthesis and its significance for life on earth. This hardly researched case of enquiry is a representative example of science as a messy but pragmatic method for acquiring trustworthy knowledge. His works offer a privileged and hardly known starting point for a philosophical enquiry into the history of biology as well as the dynamics of science in general, based on as yet unstudied letters and documents and a reconstruction of his experimental method. A multidimensional and historical perspective on his research may also explain why he disappeared in the mists of time and why nobody can claim the discovery of photosynthesis.

**Christine Manganaro**, University of Minnesota

*Race Crossing in Hawai'i: Harry L. Shapiro and the Chinese-Hawaiian Project, 1926-1936*

Beginning in the late 1910s, physical anthropologists framed Hawai'i as an ideal site to investigate the consequences of miscegenation. Race mixing received special attention during the interwar period, when race was widely understood as a biological phenomenon while also at the center of debate over the role of environment in creating human differences. This paper examines Harry L. Shapiro's physical anthropological research on approximately 8000 Chinese immigrants, their relatives remaining in China, their children, and Chinese-Hawaiian "hybrids." I investigate the presumptions and design of this project commissioned by the University of Hawaii and funded by the Rockefeller Foundation. The study promised general, practical scientific knowledge about heredity and race as well as specific information about the qualities of the racially mixed population of Hawai'i, which the United States officially colonized in 1898. The study was never published, however, and has received minimal attention in biographies of Shapiro and histories of anthropological work in the Pacific. Correspondence and interviews with subjects reveal subject noncompliance with Shapiro's research assistants, demonstrating theoretical differences between researchers and subjects' conceptions of race as well as resistance to racialization. In addition to detailing this physical anthropological work during the interwar period, a time of profound changes in the field of American anthropology, my paper illuminates an episode in the history of colonial Hawai'i and U.S. history when scientific experts and colonized people engaged in dialogue about what race was and who determined the categories.

**Amy Margaris**, Oberlin College

*Arctic Exploration & Ethnological Collecting in Historical and Contemporary Perspective*

The convening of the Fourth International Polar Year (2007-2009) provides an opportunity to examine the impact of 19th century scientific exploration on the development of ethnological collecting in arctic regions by famed Smithsonian Institution naturalists like Murdoch, Ray, Turner and Nelson. The rediscovery of a small arctic collection, obtained by Oberlin College in 1889 through a Smithsonian exchange, opens a window on this period and provides an opportunity to assess a new era of international partnership with explicit focus on both climate change and Native northern peoples. Many objects in the Oberlin collection were acquired by Edward W. Nelson whose 1877-1881 Alaska work coincided with the preparation and launch of the First International Polar Year (1881-1884), a grand scheme of collaborative circumpolar climate research conceived by Austrian explorer Karl Weyprecht. Nelson collected an astounding 10,000 ethnological specimens, from ivory dolls to fish skin bags, and challenged Smithsonian practice by insisting that his collections not be scattered through donations or trades. The early collectors of arctic material culture employed rigorous standards for specimen documentation allowing us to reconstruct collection practices, including how ethnological specimens were obtained, the types of materials sought, and their disposition in later years. We discuss the relatively small portion of the Nelson material that was dispersed, including the surprising Oberlin component. Our research reveals many details about the historical circumstances surrounding the acquisition of these materials during the 19th century that will be of interest to scholars and First Peoples alike.

**Daniel Margocsy**, Harvard University

*Encyclopedias and the long-distance exchange of specimens*

This paper investigates how encyclopedias facilitated the long-distance exchange of specimens of natural history in the early 18th century. It explores how natural historians developed a common system of identification for plants and seashells before the introduction of Linnaeus' binomial system. This communicative system was necessary for the development of a complex, long-distance commerce of specimens. Otherwise, a natural historian in Russia would not have been able to specify what particular species they wanted to order from their correspondent in England. This system of identification was based on the widespread availability of encyclopedias. Specimens were not identified by a proper name, but by reference to such an encyclopedia. For instance, if a natural historian wanted to acquire an English plant, he or she could open Parkinson's Flower Garden and find the description of that particular species on a certain page. S/he could then send this page number to a correspondent in England. The English correspondent would open the Flower Garden, find the description on the right page and then select and send the corresponding plant from their garden. This coding system was mutually comprehensible as long as correspondents owned the same works of natural history. My paper thus hopes to show that the late 17th-century taxonomical turn of natural history was driven as much by practical, commercial needs as by a desire to discover the hidden order of nature.

**Harry Mark**, Independent Scholar

*The common view of Michelson's experiment*

The null results of Michelson's ether-drift experiment were so astounding that many authors felt obliged to interpret them to other scientists and the public at large. It was often done in connection with the Theory of Relativity. The interpretations compared the paths of light in the experiment to the motions of swimmers or boats in a flowing river. The poster depicts them by line drawings accompanied by short explanatory texts. The similarities and contradictions to the actual experiment are thereby explored.

**Alberto Martinez**, University of Texas at Austin

*From Ampère's kinematics to Einstein's relativity*

In 1834, owing to an interest in how engineers described machines, André-Marie Ampère defined kinematics as the study of motion as it appears to observation. He construed it as the fundamental physical science, prior to statics and dynamics. Yet some physicists misconstrued kinematics as the pure geometry of motion, independent of empirical knowledge. The fledging science of kinematics was pulled in various directions by physics, mathematics, philosophy, engineering, and psychology. My talk will outline the branching evolution of kinematics, as a case study of how one would-be science splintered repeatedly into various sciences, giving particular attention to how the competing trends contributed to the emergence of Einstein's kinematics in his special relativity of 1905.

**Janet Martin-Nielsen**, University of Toronto

*Private Words, Private Actions: The "MIT Space" and Chomskyan Linguistics, 1957-1968*

In 1957, Noam Chomsky – working at MIT's Research Laboratory of Electronics – revolutionized American linguistics with the introduction of Transformational Grammar. Transformational Grammar differs radically from earlier schools of linguistics: whereas earlier schools held a behaviorist and empiricist view of language, Transformational Grammar assumes a rationalist, mentalist, and realist outlook. By 1968, Transformational Grammar was the prevailing paradigm in American academic linguistics. In this paper, I focus on the impact of the "MIT space" on the rise of Transformational Grammar. I argue that the historical, physical, and intellectual manifestations of the "MIT space" had three key effects on the development and eventual dominance of Transformational Grammar: (1) MIT's World War II legacy enabled Chomsky to secure funding and attract good graduate students to his conception of linguistics at a time when academic linguistics in America was in a pre-professional stage; (2) The intellectual spirit at the Research Laboratory of Electronics fostered a culture of underground literature which granted those with close connections to the institution privileged access to new research; and (3) The shared attitudes of MIT faculty and students towards the Vietnam War created a rallying point for MIT linguists, strengthening the cohesion and solidarity of the group on both political and academic fronts. I conclude that the private words and private actions of the Cold War "MIT space" played a vital role in the rise of Transformational Grammar between 1957 and 1968.

**Christina Matta**, University of Wisconsin-Madison

*Finding a stable species: Physiology and specificity in Ferdinand Cohn's bacterial taxonomy*

In 1872, botanist Ferdinand Cohn published "Untersuchungen über Bakterien," in which he presented his four-part taxonomy of bacteria. He drew extensively upon his background in plant physiology, and, unlike his predecessors (notably Christian von Ehrenberg), he used pigmentation, fermentation, and pathogenicity, not morphology, as the criteria by which genera and species should be assigned. These characteristics, he argued, were products of an organism's physiological properties and processes and thus could be used as stable identifiers because they did not vary even under different experimental conditions. Historiographically, Cohn is best known for his role in Robert Koch's research on *Bacillus anthracis*. Yet by the time Koch first approached him in 1876, Cohn had already developed a taxonomic system based on physiology rather than morphology – a distinction that proved important to medical bacteriology and claims of disease specificity. In this paper, I will argue that Cohn's research into bacterial physiology demonstrates the strong connections between experimental plant physiology, medicine, and chemistry. Interpreting nineteenth-century bacteriology as physiological offers an alternative to the pathogenic paradigm, and, by acknowledging interdisciplinary debts, demonstrates bacteriology's debt to nineteenth-century botany and plant physiology.

**Aaron Mauck**, Harvard University

*Pricing Thrifty Genes: Chronic Disease and the Thrifty Gene Controversy, 1962-1989*

During the twentieth century hereditary mechanisms were often proposed to account for increasing chronic disease rates. Prominent among these was the thrifty gene hypothesis, proposed by James Neel in 1962 to explain high rates of obesity and type 2 diabetes among Native American populations. This hypothesis held that traditional diets resulted in an adaptation allowing these populations to store fat in times of plenty for ensuing times of want. As these were replaced by modern diets, this selective advantage became a genetic liability. In the decades following its initial formulation, this explanation became a mainstay in the discussion of obesity and diabetes. It was also a source of significant controversy: As an account of pathogenesis, it appealed to those interested in assessing the biological consequences of socioeconomic change. But the emphasis on genetic foundations also gave rise to misgivings, as the search for thrifty genes appeared to pathologize an apparently normal adaptation to environmental circumstances. Rather than appealing to genetics, critics of the hypothesis suggested that emphasis be placed on socioeconomic disparities and cultural preferences as the primary factors involved in pathogenesis. This paper charts the history of this controversy from the initial proposal of the hypothesis to its rejection by Neel himself in 1989. During this period geneticists and health care professionals engaged in a widespread exploration of the interaction between genes and environment in chronic disease, and also employed an adumbrated form the hypothesis to inform social and medical assessments of the potential pitfalls of global economic development.

**Grischa Metlay**, Harvard University

*Risky Drinking: Conceptions of Risk in Debates about Prohibition, 1900-1920*

I examine expert debates about the scientific bases American Prohibition, arguing that they exemplify a unique moment in the history of risk and risk perceptions. Previous work has identified distinctly modern elements in conceptions of “risk” (e.g., appeals to scientific or quantitative precision, and prevention through improvement) that distinguish it from earlier notions of “dangerousness” (e.g., emotive appeals to fear, and prevention through avoidance). Given the strong links between American Progressivism and the ideology of science, this period is a promising place to look emergent notions of risk. My work examines the aims and bases of Progressive strategies to prevent, or at least minimize, the negative effects of moderate drinking on the body and the body politic. It suggests that national alcohol policy was their favored strategy for affecting individual drinking practices. And they studied the risks of moderate drinking by conceptually dividing the work into causal (in this case, physiological) and statistical (in this case, mortality rates) components. However, Progressive experts on alcohol encountered technical and conceptual hurdles that stymied consolidation behind a consensus position. Faced, then, with intractable scientific uncertainty, experts fell back into idioms better suited to notions of dangerousness dominant in the nineteenth century. For example, Wet and Dry physiologists responded by abandoning scientific precision in favor of common sense and prudent asceticism, respectively. Overall, Progressive alcohol experts were unable to solve the problems that they posed, but they appreciated the promise of risk as a public health tool, setting the foundation for future research.

**Sally Metzler**, Independent Scholar

*The Emperor and the Alchemist: Habsburg Patronage of alchemy and Its Impact on the Arts*

During the Renaissance the pursuit of alchemy, namely transmuting base metals into gold, was a noble quest in terms of patronage and goals. Royalty was seduced by the alchemist’s promise of abundant treasuries, while scholars of alchemic philosophy insisted on alchemy’s attainment of eternal wisdom. But alchemy played a much larger role than financial gain and spiritual wisdom. The Habsburgs, including Emperor Maximilian II and his son Rudolf II, embraced alchemy, favoring not only its practitioners, but also doctors, metalurgists, and artists who incorporated alchemy into their endeavors. My paper will address the rarely considered impact that alchemy had on these seemingly disparate disciplines, particularly focusing on the visual arts during the sixteenth and early seventeenth centuries. Through my examination of Habsburg patronage of alchemy, I examine figures such as Paracelsus and Leonard Thurneysser (1530-1596), who published “Magna Alchemia,” a work that included sections on Bohemian and Hungarian mining. Endeavors of mining and gemology were similar to alchemy in that the pursuit was financial as well as spiritual. A major consideration will be the nexus of alchemy and visual art, focusing on the Prague chamber of wonders of Rudolf II (1552-1612). I posit a new interpretation of Rudolf’s collection, demonstrating how alchemic philosophy permeated artistic goals of the major Prague court artists of the day. Sally Metzler, Ph.D. Chicago

**Michal Meyer**, University of Florida

*Conducting Science: The Different Roles of Physical Geography*

Physical geography – the study of the earth and its inhabitants – was a quintessential nineteenth-century science. Those who wrote for a scientifically inclined general audience found in the subject a suitable vehicle for discussing nature, empire, and progress. In this paper I wish to focus on the notion of “conduct.” There are two senses in which such a focus can be helpful - conduct in terms of the authors’ function as a guide to their subject, and conduct or behavior of those doing the science that appears in the text. This metascientific level sheds light on the relationships found among nature, empire, religion, and progress and their connection to species extinction. Two well-known British writers on the subject of physical geography sprang from different backgrounds. Mary Somerville (1780-1872), who published her first edition of *Physical Geography* in 1848, occupied an elite position in the scientific world: recognized as a mathematician, provided with a government pension, awarded memberships in various scientific societies, and enjoyed personal friendship with many of the leading scientific thinkers of the day. Whereas Rosina Zornlin (1794?-1859) the author of *Recreations in Physical Geography, or the Earth as it is*, which first appeared in 1840, was the invalid daughter of a wealthy broker who wrote elementary books on many scientific subjects. Somerville and Zornlin each produced a book different in tone, scope, and assumptions about the role of science, and a comparison of the two highlights the differing didactic styles that science popularizers took.

**Victoria Meyer**, University of Virginia

*Giving the Pox: A Case of Medicine and Polemic in Enlightenment France*

This paper examines the relationships between Enlightenment philosophy, medicine, and public opinion in eighteenth-century France through the lens of counter-Enlightenment journalist Elie-Catherine Freron's unexpected defense of inoculation against smallpox. From 1745 until 1775, Freron greatly influenced public opinion in France through his various periodicals, such as *l'Année Littéraire*. During this period, he often became embroiled in disputes over various reform measures and inventions. The most intriguing cause adopted by Freron, however, was his fierce promotion of the controversial inoculation of smallpox. Inoculation of smallpox is a medical procedure whereby a healthy patient is purposefully infected by the insertion of a small amount of smallpox pus into incisions in order to protect the patient from smallpox. Historians have attributed the introduction of inoculation in France to Enlightenment philosophes in the 1750s, when in actuality inoculation was first discussed in France in 1714 when reports of the procedure arrived from Constantinople. Scholars have directly linked the increasing concern over mounting smallpox deaths in the eighteenth century and the philosophes' program of reform. The historiography has focused thus on a view of inoculation as philosophe propaganda and as the Enlightenment's greatest medical invention. The virulently anti-Enlightenment Freron's ardent defense of inoculation in the public sphere in collusion with philosophes demonstrates, however, that this portrayal is oversimplified. It also raises questions of authority in the public sphere, particularly concerning issues of health and medicine, and the changing conceptions of proof, all which will be discussed in this paper.

**Erika Milam**, Max Planck Institute for the History of Science

*The problem with beauty: aesthetics, rationality, and female "choice"*

Why does beauty exist in the natural world? When scientists in the first decades of the twentieth-century struggled to explain beauty within a naturalistic framework, they faced two problems. The first problem was how to explain the extravagant beauty of animals, especially as evidenced by courtship displays, if animals possessed no aesthetic sensibility. As humans, we might appreciate the beauty of a peacock's tail, but claims that the peahen chose her mate based on the brilliance of his display struck many scientists as inappropriately anthropomorphic. The second problem was to explain cultural variations in the determination of what constituted beauty in humans. In addressing these issues, scientists and sexologists linked animal and human courtship behavior in two very different ways. They either framed animal courtship as an evolutionary forerunner to marriage choice in humans, or described animal courtship as a physical process akin to each act individual act of human "love-making." Whereas female choice of partners in animals implied comparison and aesthetic appreciation on the part of the participants, a physiological description of courtship painted animal (and human) actions as non-cognitive and instinctual. In both cases, courtship and mating habits could act to increase the beauty and reproductive success of the inevitable offspring, but biologists and sexologists reserved rational choice as an evolutionary spur solely for humans. The history of mate choice reflects a careful negotiation of the implied aesthetics and rationality of choice-based behavior in humans and other animals.

**Mara Mills**, University of Pennsylvania

*Signal and Noise: The History of the Audiogram*

In 1922, Bell Laboratories engineer Raymond Wegel collaborated with otologist Edmund Prince Fowler to develop the first commercial, vacuum tube audiometer. They proposed that an "audiogram," a plot of minimal audibility per frequency, replace other charts of hearing acuity. Hoping to use speech and hearing norms as a mold for the design of efficient telephone apparatus, AT&T began working with the New York League for the Hard of Hearing to screen the ears of children in state schools (and later measure the hearing of adults at the 1939 World's Fairs). The United States Health Survey of 1935 used the AT&T audiometer, and the assistance of Bell engineers, to test thousands of ears across the nation. These surveys set the "reference zero" for a new kind of audiogram – one that measured hearing loss, or the deviation from a national norm. A noise panic of sorts resulted. Millions of American schoolchildren, and almost all adults over the age of 30, were believed to have hearing loss. Communication engineering – the manufacture of equipment and the processing of signals–experienced a similar obsession. Audiometry became a means for measuring the "deafening effect" of noise in rooms and on telephone lines. This paper narrates the emergence of the "normal" hearing standard, its application to equipment design, and its eventual contestation by laboratory-based studies. I will argue that deafness became a "communicable disease" in the first half of the twentieth century; anyone's hearing could be disrupted by the environment, by equipment, or by other people.

**Sarah Mitchell**, University of Southampton

*Science or Spectacle: The Tale of a False Dichotomy*

Recent controversies over the public display of bodies, such as that generated by Gunter Von Hagens's plastinated bodies exhibits, get at the larger issue of whether or not such displays of human anatomy are scientific or spectacular; educational or entertaining. Implicit in these comparisons are the assumptions that scientific and educational are more valid and that the two categories are mutually exclusive. This paper situates this ongoing, contemporary controversy in historical context through examples of the ways in which live humans on display in the mid-19th century were perceived at the time by both the general public and by scientific/medical communities. I provide a brief overview of the varieties of human display that were prevalent at the time, then focus specifically on the public exhibition of enslaved American sisters Millie and Christine McKoy (1851-1912), also known as "The Two Headed Nightingale." Why did these types of displays that were largely unopposed in the mid-19th century become so unacceptable in the mid-20th century? What role did the professionalizing sciences play in shaping public opinion? Why have academics been so vested in dismissing the popular, the entertaining and the spectacular? This paper suggests that there is much to be gained by a new approach to the "science or spectacle" debate and proposes a potentially more constructive view of the relationship between them that moves the focus from the object or individual in question to the individual or group doing the observing. The relationship between the two is historically contingent.

**Hiromi Mizuno**, University of Minnesota, Twin Cities

*Scientific Nationalism in Japan*

My paper explores the history of scientific nationalism in Japan, a kind of nationalism that emphasizes the development of science for the sake of the nation. It will do so by examining the politics behind the Japanese term, *kagaku gijutsu* (science-technology). This term is most widely used in Japan to refer to the general fields of science and technology; so widely used that its origin has been forgotten. It was coined by technocrats in 1941 to promote military technology at the sacrifice of basic science and social sciences. By redefining science in such a specific way, these technocrats schemed to take control over science policy away from the hands of the ministry of education. While the term “science-technology” after WWII lost the initial technocratic message, my paper argues that it is important to look back the wartime politics behind the term “science-technology” now. The Japanese government has been promoting the vigorous science-technology policy in the past fifteen years, and I have found the discourse around the current science-technology policy to be very similar to that of wartime Japan: most notably the discourse that designates the survival of the nation in the competitive world directly to the need for science and technology to be planned, managed, and controlled by the central government. While I discuss such discourse as that of Japanese scientific nationalism, my discussion is relevant to Korea, Taiwan, and China as “science-technology” has been translated into Korean and Chinese and shaped discourses and policies in those nations from the early 1940s onward.

**Georgina Montgomery**, Michigan State University

*“Trusting Friends:” Robert Mearns Yerkes and “Miss Congo”*

Robert Mearns Yerkes performed science in a diverse range of places, including the private estate and circus. According to Yerkes, such sites had characteristics that made them valid and useful places for science. This paper will focus on Yerkes and a gorilla called Congo, the habitats they shared and the relationship they formed. In what ways were Yerkes and Congo “trusting friends?” How did Congo participate in Yerkes’ research and with what consequences? These questions explore the role of animal subjects in animal behavior research, questions echoed throughout the session as a whole. Exploring such sites also allows us to recognize the significant contributions of individuals located outside of the traditional scientific community to primate studies during the early to mid-twentieth century.

**Kelly Moore**, University of Cincinnati

*Fighting Fat: The USDA, the Cold War, and Standards of Bodily “Fitness”*

Anxieties about Americans’ physical fitness have occupied observers as far back as the late nineteenth century. In the early post- World War II period, surveys by exercise researchers and the Department of Agriculture’s human nutrition specialists sounded a new alarm: not only were American men unlikely to be fit for recruitment into the military as a result of poor diet, Americans’ poor eating and exercise habits also put the nation at risk of a major population decline due to chronic illness. If Americans did not become more “fit” argued nutrition and exercise scientists, the nation was at serious risk of losing the Cold War. This article examines the scientific and political formation of the concept of “fitness,” and the attendant risks of failing to produce a “fit” population, through an examination of the President’s Council on Physical Fitness.

**Jill Morawski**, Wesleyan University

*The Psychology Experiment as Coercion*

In a poem written in the 1920s, Amy Lowell castigated an experimental psychologist for attempting to entice her to be a research subject, which, as she noted, would unduly constrain her actions and spirit. Lowell’s poetic protest is among a small handful of public statements on the coerciveness of psychology experiments. However, during the two decades following the Second World War, researchers themselves apprehended certain coercive elements of the psychology experiment. Some reported observations of subjects forced to act, and several psychologists made detailed analogies between the psychology experiment and authoritarian governments. This paper surveys the appearance of a sense of coercive experimentation and elucidates this anxious scientific regard in terms of a Cold War culture attentive to personal freedom, the limits of conformity, and the darker sides of science. Such morally tinged contemplations of experimentation, it is suggested, influenced the American Psychology Association’s decision in the mid 1960s to develop a formal code governing the ethics of experiments with humans.

**Samantha Muka**, Florida State University

*Sacralized Health and Social Reform: Protestant and Catholic Reactions to Syphilis in America 1900-1914*

Despite the amazing historical research done on syphilis and American culture at the turn of the twentieth century, little has been written about specific religious reactions to the disease and the battle for its eradication. The overall image presented has been one of fitting religious reactions into a secular/sacral framework: liberal Protestants were nearly secularized, while Catholics were almost completely opposed to modern scientific advances. Through analysis of religious literature and periodicals of the period, a fuller picture of religious social reform movements involving syphilis eradication emerges. Protestant and Catholic reactions to syphilis at the turn of the century are more complex than just “secular” or “sacral”. Instead, they offer images of religious recognition of the burgeoning world of modern science and their place in it. Although many objectives and reform avenues shifted in both groups, the seeming appearance of secularization is directly mirrored by a sacralization of new medical techniques and social reforms. This work seeks to highlight the misapplication of labels applied to religious groups in the early twentieth century due to their social reform efforts involving disease eradication. By concentrating on a disease that was seen as both a moral and physical illness, and that experienced major medical breakthroughs during the period, we can view the dual duty that these groups felt that they were performing; both as a moral compass for the entire nation and as a physical guard for the Christian future.

**Tania Munz**, Max Planck Institute for the History of Science

*Bees of the Hive*

“Bees of the Hive” explores the scientific and cultural journey the honeybee underwent over the course of the twentieth century. Bees had long served as models for how a well-run social polity might function – their selfless work ethic, generous provisions of honey, the seemingly rational division of labor within the hive, and the beautiful elegance of their combs earned honeybees sustained admiration and study. But during WWII, the status of the bees was to change dramatically – the experimental physiologist (and later Nobel Laureate) Karl von Frisch discovered that the bees communicate the distance and direction of food sources to their hive mates by means of their dances. Language had long been considered a window into human souls and minds and the startling discovery of a communicating insect challenged conventional notions – not just of the bee – but of what it meant to be human. This paper traces the transition of the bee as a physiological and sociopolitical creature to one of the most-studied problems of non-human communication in the post-war period. By focusing on the bee, the paper will also consider whether such a single-animal study can effectively meet recent calls in animal studies to effectively consider animal agency.

**Carla Nappi**, Montana State University

*The Order of Things: Translating Chinese and Arabic Nature In Early Modernity*

The boundaries and peoples of China changed dramatically in the early modern period, and Chinese natural history and medicine transformed along with the boundaries of the empire. Naturalists struggled to cope with a pharmacy’s worth of new and unfamiliar substances, texts, and terms, as plants, animals, and the drugs made from them traveled into China across land and sea. My paper treats one crucial aspect of this phenomenon: the early modern exchange between Islamic and Chinese medicine. This paper will explore the power of linguistic and textual technologies in shaping Chinese-Islamic medical and natural history exchange in the early modern world. The ordering of knowledge in bilingual dictionaries and translation manuals directly informed both the translation of Arabic and Persian medical texts into Chinese, and the sense made of the resulting concepts within the context of Chinese materia medica. I will look at the intersection of words, categories, and other forms of transmission that mediated this exchange, with a special emphasis on the importance of bilingual dictionaries and glossaries (and the way knowledge was ordered therein) in shaping early modern Chinese- Islamic scientific and medical interaction.

**Omar Nasim**, Max Planck Institute for the History of Science and the MPI for History of Art

*Observation and the Hand: Observing Books and Nebular Research*

In 1845 the third Earl of Rosse (William Parsons) built the largest reflecting telescope in the world. The primary motive for building this ‘Monster’ was to advance the nascent Nebular research. What I am interested in are the number of Observing Books which contain hundreds of drawings made of nebulae, as they were seen during nightly observations. Not only were many drawings made of various kinds of nebulae, but many drawings were also made of one and the same object. The movement of a single object through the different books, not only point to different functions and research interests, they also indicate various ways in which the images acted as tools within the procedures of observation. I wish to examine the nature of the Observing Books and ‘the Ledgers’, especially in relation to the drawings made prior to the printed illustrations. The printed engravings, however, cannot be ignored altogether, and will be used to cast further light on the expectations and reactions of astronomers at the time from such research procedures. At the end, a philosophical question of the epistemic status of these drawings, in their different stages and functions, will be addressed.

**Catherine Nisbett**, University of Chicago

*Managing Vertical Distance: the Harvard College Observatory’s Boyden Expeditions*

In 1897 the Uriah Boyden bequest was disbursed to Harvard University on the condition that it be used by the Harvard College Observatory to establish a high altitude station, free – as far as possible – from the injurious effects of the atmosphere. At \$230, 000, Edward Pickering, director of the HCO, could hardly decline the money, but since the HCO was not itself on a mountain, he was forced to do what he had always been reluctant to do: send men on expeditions. The Observatory sent three expeditions in the next three years, to Pike’s Peak in Colorado, Mount Wilson in southern California, and Mount Harvard outside of Chosica, Peru. Pickering ran a tight ship at the HCO, but he was unable to translate his home management strategies to distant camps. Where the work environment of the HCO was lab-like, the mountain was anything but, with staff acting as astronomers, meteorologists, diplomats, and administrators; sometimes living in paper houses; surviving severe snowstorms and sickness. In the observatory, professional identities were distilled into observer, computer, or more broadly, astronomer. In the field, professional identities, along with the data to be gathered, were plural. The mountain also imposed special conditions on workers. It was first and foremost a problem to be solved. The distance from the home institution was exaggerated by moving upward on the mountain, as were the practical difficulties of administering a station and conducting astronomical and meteorological work. This paper will explore the particular difficulty of managing vertical distance.

**Mary Nye**, Oregon State University

*Scientists in Power: Pioneering the Modern History of Physics*

This paper examines ways in which Spencer Weart’s *Scientists in Power* was a pioneering book when it first appeared in 1979. It was pioneering in at least two senses. First, it was pathbreaking in the kinds of sources and methods that it used, including its use of oral history. Secondly, the book was pioneering in its emphasis on studying the modern nuclear physics community within institutional, social and political structures. In particular, Weart’s analysis challenged historians to examine the intersection between scientific expertise and political power.

**Clinton Ohlers**, St. Joseph's University

*The Place Of Victorian Scientific Naturalism In The History Of Science And Religion: Great Britain And America, 1830-1934*

In the wake of Darwin's *Origin of Species*, an influential circle of scientists and philosophers of science now known as the Victorian scientific naturalists brought to the professionalizing world of science and to the public a new and controversial definition of what science was. The construction of science they advanced was founded on the commitment to a concept known in their day as the "absolute uniformity" of nature. By this they meant that nature was an unbroken chain of material cause and effect. The Victorian scientific naturalists championed a profound departure from the science of earlier leading British naturalists and philosophers of science, such as John Herschel, Charles Lyell, and William Whewell, who dominated the first half of the nineteenth century and who adhered to a uniform view of nature's laws, while leaving room for the God of traditional theism. This paper examines the demarcation of science and religion that emerged during this period and the historical narratives scientists, philosophers, and popularizers of science offered in support at critical stages in its development. Ultimately, by making commitment to nature's absolute uniformity the *sine qua non* of technical and popularized scientific discourse, the Victorian scientific naturalists ensured the dominance of a construction of science that by definition rendered null and void all theistic claims regarding divine action in the physical universe. The scientific naturalists' exclusion of theism also heightened the appearance of conflict between science and religion, thereby spurring the development of the "warfare" metaphor that became popular during this period.

**Naomi Oreskes**, University of California San Diego

*You Can Argue With the Facts: A Political History of Climate Change*

Scientists generally subscribe to a supply-side model of knowledge--supply the knowledge and it will trickle down to whomever needs to know it; but empirical evidence is against this view. For facts to travel, they must extend beyond expert communities into nearby scientific domains that share borders, and thence into still larger communities for whom those facts may be pertinent. In this process of expansion or extension, facts may encounter forms of resistance distinct from the processes that established them in the first place. If people have reasons to resist the knowledge being presented, they can and will argue with the facts, often quite effectively. This is clearly the case in the recent history of climate science, where various groups have opposed the evidence supplied by expert communities. This resistance has taken various forms, including arguing over the significance of facts; questioning whether the proffered facts actually were facts; and providing an alternative set of facts to re-frame the entire question of global climate change. Today, 40% of Americans think that there remains "a lot of disagreement" among scientists about the reality of anthropogenic warming. This suggests that the resistance campaigns were effective in creating a lasting impression of scientific debate and discord, and that when the fact of global warming traveled, it left its scientific parents behind.

**Margaret Osler**, University of Calgary

*What Does Religion Have to Do with the Scientific Revolution*

The Scientific Revolution has served as the linch-pin of the history of science at least since the late nineteenth century, although it did not acquire that name until the 1930s. Usually referring to the period between Copernicus and Newton (roughly 1500 and 1700), it has traditionally served as the *terminus ad quem* for the ancient and medieval developments that preceded it and the *terminus a quo* for all that followed. According to traditional accounts, this period witnessed the birth of modern science and its attendant methods and institutions. Not itself an explanatory concept, the Scientific Revolution has become the reference point for questions that guide historians of science, questions about what it was, what exactly happened, why it happened, and why it happened when and where it did? The past century has witnessed many changes in the historiography of the Scientific Revolution. An account of these changes reveals the close relationship between conceptions of the Scientific Revolution and assumptions about the relationship between science and religion. Twentieth century accounts of the Scientific Revolution were deeply influenced by Comtean positivism and by North American controversies about Darwinism. They tended to interpret the Scientific Revolution as a liberation from religious domination. More recently, in step with revisions of our understanding of science and natural philosophy in the early modern period, historians have taken more moderate views, recognizing the complex relationship between science and religion.

**Abena Osseo-Asare**, University of California, Berkeley

*Scientific Citizens: Experiments in Flag Nationalism and Laboratory Science in Ghana, 1956-1977*

This paper considers the history and legacy of a key government policy in African countries during the 1950s through 1970s: the popularization of science among everyday people. African heads of state in the period associated science and engineering with their potential for success. They invested heavily in the science education denied colonial subjects; a few even adopted nuclear technologies to secure national sovereignty. In Ghana, officials in the Ministry of Education and Information strategically invoked both science and nationalism to create what I term 'scientific citizens' after independence from Britain in 1957. Schools became an important site for the production of this new class through the introduction of two major social experiments: (i) recitation of the national anthem and pledge, and (ii) special lessons in new school laboratories. Ironically, both depended on imported goods including phonographs, flasks, microscopes, and textbooks. Student appropriation of these objects suggests new patterns in the circulation of modern science and nationalism. The paper draws on post-independence government reports and correspondence, and recollections of individuals who attended school in Ghana during the period. Over the past half-century, science education in Ghana has taken on specific cultural values with young boys in particular pushed into rigorous mathematics, physics, and engineering programs. Yet, job opportunities for science graduates are slim today. While Ghana's current leaders still value "hard science", the legacy of education policies under first President Kwame Nkrumah, young people increasingly turn to business degrees, or "the arts" in hopes of a better life.

**Eric Palmer**, Allegheny College

*The best of all Panglosses*

Scholars have recently associated the character of Pangloss in Voltaire's *Candide* with figures such as Gottfried Leibniz, Alexander Pope, and Christian Wolff. Pangloss is a pastiche, but Voltaire had a particular target who is almost always missed, and whose writing and biography as a tutor fit Pangloss particularly well – so well that Pangloss paraphrases him extensively in the first chapter of *Candide*. In many of his aspects, Pangloss is the specific parodic image of Noël Antoine Pluche (1688-1761), a popularizer of science who is the author of one of the most printed and most translated works of the mid-18th century, *Le Spectacle de la Nature*. This presentation indicates the references in *Candide* and makes the case for casting Pluche as a significant opponent in Voltaire's eyes. Pluche, as well as being the most popular among contemporary physico-theologians, promoted a unified ideal of intellectual enlightenment, in an epistemology wedded to pious humility that differed markedly from the approach of the philosophes. Voltaire often chose the strategy in his attacks of lowering Pluche by disdaining to name him as an adversary, as he did in *Candide*. Voltaire's repeated invective against the figure he called the "charlatan among ignoramus" have been neglected in recent scholarship, as a consequence of Voltaire's strategy, and of Pluche's subsequent eclipse by Buffon. A look at Pluche can serve to help us build our understanding of the importance of this figure and of the significance of popular scientific writing in French culture.

**Paolo Palmieri**, University of Pittsburgh

*Comparative study of experimentation in the physical sciences in c17-18*

We have set up a laboratory for investigating the nature of experimentation in the physical sciences from the early seventeenth century to the end of the eighteenth century. The project aims at casting light on the emergence of controlled experimentation as a reliable means of investigation, especially in the physical sciences. We wish to understand how controlled experiment underpins early modern scientific knowledge. We built apparatus to replicate controversial experiments by Galileo and Coulomb. We are currently planning on building more apparatus for early optics and music theory. We experiment, so to say, with the "experiments" themselves, that is, we explore the parameters that make an experiment succeed or fail. We found out that some experiments degenerate when parameters are gradually altered. This peculiar fact is not reported in the historical record. It is by focusing on how experiments succeed or fail, and on how success and failure are understood by historical actors, that we hope to cast light on the emergence of controlled experimentation as a basis for early modern scientific knowledge.

**David Pantalony**, Canada Science and Technology Museum/University of Ottawa

*Teaching with artifacts: the museum context*

Instruments have become a big part of the history of science. Remarkably, they are seldom part of the classroom experience. Rich Kremer (this panel) will be describing teaching with a university collection of scientific instruments within an academic context. The heart of the course is an effective method for examining artifacts. The benefits to students and the university are enormous. But what happens when we do this in a museum? There are thousands of museums across North America, large and small, that contain scientific and medical materials. My talk is based on a fourth-year history seminar (University of Ottawa) taught at one of Canada's national museums, the Canada Science and Technology Museum. The classes take place in the storerooms of the museum amidst shelves of diverse instruments and technologies. Students are exposed to conservation staff, cataloguers, and curators linking them to a wide spectrum of material culture. Their presence, in turn, stimulates new thinking within the museum itself. My talk will describe this setting and how, aside from benefits to students, an artifact-based course can serve as a guide for collection research, exhibitions, education programs and public tours. Even a small seminar can have a significant impact on the way the collection and artifacts are viewed by museum staff and the public. For example, small versions of the sessions can be replicated with curators, exhibition teams, educators and guides. The intended outcome is a public presentation of history and science that reflects recent scholarship in our field.

**Katharine Park**, Harvard University

*Watching and Waiting: Observation in Medieval Theory and Practice*

Medieval scholars made a clear distinction between observation (*observatio*) and experience (*experientia/experimentum*) as sources of knowledge about the natural world. Whereas experience had the sense of "trial" or "test" – a punctual intervention intended to test the truth of a statement, the accuracy of a planetary table, or the efficacy of a remedy or procedure – observation was organized around the idea of watching or waiting and referred to the patient noting and recording of long term, often cyclical, phenomena in order to determine patterns and correlations, e.g., among planetary configurations, weather conditions, times of harvesting and planting, or changes in the political or religious order. More generally, experience characterized mature sciences, which needed only to be calibrated and perfected, while observation characterized the conjectural sciences (astrology in the first instance, but also agriculture and navigation) and bodies of knowledge in formation. As the etymological association with waiting suggests, observational programs in the medieval sense involved stationary observers tracking changes over long periods of time – months, decades, or even centuries – rather than mobile observers gathering data from far-flung locales. Although medieval writers typically attributed observation to the ancient founders of the sciences (e.g., the Babylonians, the Egyptians, the pre-Hippocratics), there is clear evidence of localized medieval observational enterprises focused on monastic timekeeping and, beginning in the 13th century, weather science.

**Karen Parshall**, University of Virginia

*The Internationalization of Mathematics in a World of Nations: 1800-1960*

In the nineteenth century, mathematicians began increasingly to view their discipline as one developed and negotiated not exclusively in individual national contexts but rather in an international arena. In the case of mathematics, this change was spurred by the self-conscious emulation in distinct national venues of what might be called the “Prussian” model of university-level training, a model that involved research, teaching, and the training of future researchers. Within this university context, moreover, many mathematical results were proven and mathematical areas developed that came to be viewed as “trendsetting.” This talk will argue that, as mathematicians east and west, north and south increasingly embraced the standards of those working in states like Prussia with whom they hoped to compete effectively, they came increasingly to share cultural standards centered on educational ideals, a desire to build viable and productive national professional communities with effective means of communication, a conviction that personal and national reputation was established in an international arena. The transformation to an internationalized field occurred, however, as mathematicians came to share not only a mathematical language but also a sense of “good” research agendas via the self-conscious internationalization of journals and the institutionalization of the International Congresses of Mathematicians (ICM) for the direct communication of mathematical results and research agendas in the opening decades of the twentieth century.

**Miranda Paton**, Paleontological Research Institution

*The Complexities of Consistency: Sewall Wright, George Gaylord Simpson and Modeling Evolution*

This paper considers the between Sewall Wright’s well known “fitness surface” diagrams (1932) and the similar diagrams at the heart of George Gaylord Simpson’s contribution to the Evolutionary Synthesis, *Tempo and Mode In Evolution* (1944). It also explores the consequences of making genetic populations and paleospecies appreciable in these same visual terms. Claiming conceptual resolution between genetic groups and fossil taxa was crucial to a “consistency argument” that brought paleontology into modern discussions of evolutionary theory. However, Simpson’s consistency argument did more: It helped legitimate population geneticists’ abstract and reductive models of change in allele frequency as adequate representations of Evolution By Natural Selection because it demonstrated those models’ applicability to contested and real data-- both higher taxa and fossil phylogenies that had been used to support more complicated “non-Darwinian” views of evolution. By the early 1940s, neither Wright nor Simpson fully appreciated that their descriptions of evolution were incommensurable because their respective taxonomic groups were also impossible to resolve in empirical terms. The growing enthusiasm for Wright’s Shifting Balance theory as a comprehensive description of evolution helped establish a reductive limits built into evolutionary biology. At the very least, Simpson’s convincing extension of Wright’s helped establish preference for selection-driven theories of evolution. The Synthesis, then, could only “harden” around natural selection after 1944, and several worthwhile questions that had troubled Darwin and others since 1859 had to be tabled.

**Alexander Pavuk**, University of Delaware

*Progressive Catholics and Evolution in the American Public Sphere: The Early Twentieth Century*

When William Jennings Bryan asked Catholic intellectuals to publicly support his cause in the 1925 Scopes Trial, he was baffled by their unilateral refusal. Bryan, probably influenced by the traditional conflict thesis view of the Catholic Church and science, hoped Catholics would join him in a larger battle against those using evolutionary theory to gird a broader attack on the public authority of religion in America. Bryan’s confused expectations are analogous to the conflict theory-related assumptions that continue to influence many depictions of Catholicism in the cultural history of American science. As some historians have begun demonstrating in recent years, depicting Catholicism as hostile to science is problematic. This paper will examine Catholic intellectuals’ role in public discourse about human origins and evolution carried out in popular books and middlebrow print media. Individualist-minded liberal Catholics played a part in negotiating the broader public understanding of science itself, and evolution in particular. Thus, their voices ought to be considered part of the broader history of science-religion relationships in the American public square. Certain Catholic intellectuals had enthusiastically embraced the rising discursive authority of science in the Progressive movement as a way to achieve intellectual and social authority. When writing about human origins with non-Catholic audiences in mind, these Catholics wrote in pragmatic, scientific terms to the virtual exclusion of (rather than in tandem with) appeals to religious teachings or Biblical authority. As such, they hoped to reveal Catholicism as broad-minded, modern, and fully American.

**Michael Pettit**, York University

*Behavioral Endocrinology, Bisexual Rats, and “the Straight State”*

One of the foundational claims made in the emerging field of behavioral endocrinology was the bisexual nature of all organisms. This was based on research conducted by Frank Beach on the sexual behavior of rats in the 1940s. When these claims were first being made it frequently identified by historians of sexuality as the time when the American state was instituting heterosexist definitions of citizenship and individual rights. The history of behavioral endocrinology (its privileged experimental organisms, theories, and patronage networks) can be productively situated in such a narrative. Attention is paid to the public uses of the science in debates about the nature of homosexuality in neighboring disciplines, the media, and law. As the field dealing with the interrelationship among hormones, the nervous system, and the environment in animals, behavioral endocrinology attracted particular moral authority as the basic science for determining the nature of sex. I am particularly concerned with how Beach successfully crafted an identity for himself as a pure, disinterested researcher where his one-time interlocutor and fellow Committee for Research on Problems of Sex beneficiary, Alfred Kinsey, was not. From the 1940s to 1970s, Beach and others constantly renegotiated the significance given to his claims about bisexuality to mitigate their social implications. Yet just as the supposed sexual repression of the Victorians produced those scientific discourses that came to challenge these ideals, so too did the behavioral sciences of the early Cold War develop counter-discourses that came to undermine the heteronormativity of official public policy.

**Christopher Phillips**, Harvard University

*Disciplining the Mind: Mathematics as the Cold War Subject*

This paper considers the extraordinary moment in the 1950s when American mathematicians and school teachers came together to develop the “New Math.” What was soon to become a caricature of failed curricular experimentation was then portrayed as a crucial and necessary intervention into the education of the nation’s youth, with international Cold War concerns spurring substantial NSF funding. Training in some disciplines can impart information deemed to be useful and it can prepare the student to become a practitioner. But only a few disciplines are said to be good for the mind, preparing the student to think well in dealing with a wide variety of life’s intellectual, social, moral, and political predicaments. Among these disciplines, mathematics has always enjoyed a special place. The secondary-school classroom is a perspicacious site for mathematical training and pedagogy: the subject was taught not only to inculcate skills for future practice, but also to discipline the mind for logical and rigorous thinking. The school curriculum became the arena in which various experts-- cognitive and behavioral psychologists, academic mathematicians and scientists, “back to basics” reformers, “progressive” educators-- advocated their particular vision of mid-century education. This paper will investigate both how the late 1950s made the “New Math” possible and how the curriculum’s developers inscribed within the mathematics itself-- the assigned problems, the introduction of concepts, the framing of techniques-- the particular politics of what ought to constitute the role of mathematics as intellectual and practical discipline for winning the Cold War.

**Patricia Princehouse**, Case Western Reserve University

*German Paleontologists vs. Intelligent Designists*

Creationists have retreated conceptually in recent years, at least in some circles such as the “intelligent- design” movement. Although 1960s and 1970s-style Young Earth Creationism has a new fortress in the “Creation Museum” near Cincinnati, attempts to insert creationism into public school classrooms and university seminars rely on vague language and frequent changes of labeling-- e.g. “creation-science” to “intelligent- design” to “objective-origins” to “critical-analysis,” etc.. Proponents cloak their recycled special creationist material using examples and terminology from HPST. Specifically, recent attempts have been made to reclothe ID from anti-evolution to anti-Modern Synthesis/neo-Darwinism. In the process, criticisms of Darwin and the Modern Synthesis are increasingly taken from German Synthesis stalwarts such as Richard Goldschmidt and Otto H. Schindewolf. However, these major figures of the German Synthesis outspokenly opposed super-natural forces as part of scientific explanations. Honestly assessed, they offer no comfort to creationists of any stripe. In this talk, I will consider whether these practitioners were anti-Darwinian, anti-neo-Darwinian, or anti-Modern Synthesis, and how their work is being misappropriated to the service of 21st-century religious politics.

**William Provine**, Cornell University

*Random Drift and the Evolutionary Synthesis*

My talk will delineate problems with the evolutionary synthesis, with an emphasis upon random genetic drift. Every assertion of the evolutionary synthesis below is false. 1. Natural selection was the primary mechanism at every level of the evolutionary process. Natural selection caused genetic adaptation. 2. Genetic homeostasis. The entire genome was organized and tied together, and even gene pools were homeostatic. 3. “One gene, one enzyme.” 4. Evolution of phenotypic characters such as eyes and ears, etc, was a good guide to protein evolution: or, protein evolution was expected to mimic phenotypic evolution. 5. Protein evolution was a good guide to DNA sequence evolution. Even Lewontin and Hubby thought, at first, that understanding protein evolution was the key to understanding DNA evolution. 6. Recombination was far more important than mutation in evolution. 7. Macroevolution was a simple extension of microevolution. 8. Definition of “species” was clear--the biological species concept of Dobzhansky and Mayr. 9. Speciation was understood in principle. 10. Evolution is a process of sharing common ancestors back to the origin of life, or in other words, evolution produces a tree of life. 11. Inheritance of acquired characters was impossible in biological organisms. 12. Random genetic drift was a clear concept and invoked constantly whenever population sizes were small, including fossil organisms. 13. The evolutionary synthesis was actually a synthesis. 14. Molecular biology has stolen from paleontology all ability to construct phylogenies.

**Valentina Pugliano**, University of Oxford

*Letters and lists for practical botanisers: apothecaries think natural knowledge in sixteenth-century Venice*

Sixteenth-century apothecaries knew how to look at nature and how to order the material inspected and the kinds of information derived from it. For them, botanising was at once an intellectual passion, a pleasurable activity and the basis for their profession. The organisation of natural knowledge responded, therefore, to various demands. If observation, description and display of specimens were the primary cognitive tools at disposal, the list became in turn a valuable instrument that allowed to communicate, preserve, and reduce first-hand experience of nature to a digestible form. Lists came in different forms and served different purposes: ordinary lists of medicinal ingredients; lists of desiderata for uncommon specimens; lists to collect on paper what could not be had and, conversely, catalogues to consult the cabinets of both the apothecary and his correspondents; finally, concise descriptions inserted in letters of naturalia just seen, procured or sent. In all this, lists served a social function. Alongside letters they provided a gateway for the participation in local and international communities of naturalists. They allowed to share knowledge and paved the way for the circulation of objects. Venice and its mainland territories seem to have offered a particularly fertile ground for the pursuit of botanical activities by a heterogeneous array of individuals. So far, however, the importance of the Serenissima as a cradle for the early modern life sciences has been neglected. So have apothecaries been ignored as a distinctive rather than derivative class of practitioners of nature. In this paper I will try to redress this imbalance by looking at the ways in which these Venetian scholars of nature used the textual and intellectual tool of the list to negotiate their observation and practical experience of the natural world.

**Sheila Rabin**, St. Peter’s College

*The Astrological Cosmos of Johannes Kepler*

Combining the ideas of Copernicus and Tycho Brahe, Johannes Kepler concluded that the universe was physical, not immaterial. That created a problem for his acceptance of astrology. Traditionally, belief in astrology had been grounded in the Aristotelian distinction between a physical sublunar world and an immaterial heavens. The celestial world could guide what happened on earth because immateriality made the celestial world superior. A physical universe meant that the celestial world lost its superiority and the consequent ability to guide us. Therefore, Kepler set about to reform astrology so that it would conform to his belief in the physical universe. This paper will look at Kepler’s reform of astrology and how it was more compatible with a physical universe than traditional astrology because he emphasized geometrical relationships, particularly planetary aspects and progressions. It will also look at his belief in planetary souls not as a confirmation of a presumed mysticism or Neoplatonism but as another means in the process of making the universe physical.

**Gregory Radick**, University of Leeds

*What Weldon Wanted: New Light on His Biometric Program*

When it comes to heredity after Darwin, W. F. R. Weldon is much better remembered for what he was against – Mendelism – than what he was for. The reasons are not far to seek. When Weldon died in 1906, his ideas about how heredity worked and how it ought to be studied had been only patchily publicized, in lectures and in his critically focused writings against the Mendelians. He didn't live to complete the manuscript in which he aimed to set out his alternative vision for the science of heredity. By reference to this manuscript and other archival materials, this paper will attempt a reconstruction of Weldon's program as he understood it. One point to be emphasized is the range of differences between Weldon and his partner in promoting anti-Mendelian "biometry," Karl Pearson. Pearson was a positivist who disdained inquiry into unobserved, putatively explanatory "factors" as unscientific; and it is Pearson's positivist version of biometry that tends now to stand for the whole. But Weldon, for all his enthusiasm for biological measurement, was no positivist. Indeed, his biometrical program embraced theorizing about chromosomal determinants whose effects contributed to the making of visible characters. Another, related point to be emphasized is that, on Weldon's view, one of the great virtues of his program was that, unlike Mendelism, it took seriously the importance of environmental conditions. For Weldon, "dominance" and "recessiveness" had to be understood as the upshot of complex causal relationships that held only when certain environmental conditions obtained.

**Peter Ramberg**, Truman State University

*Internet-Based Teaching Tools for History of Science Classes*

Recently, creating content-rich websites on the internet has become much easier with the appearance of websites that allow easy posting of material without knowledge of either complicated web design software or programming code. It is now commonplace to upload text, audio, and video files to blogs, wikis, and Youtube with a minimum amount of effort. The audio and video files can similarly be created easily with common, relatively inexpensive equipment. These new web-based technologies offer useful opportunities for teaching the history of science. This presentation will discuss how some of these new technologies are used in and out of the classroom, focussing on podcasts, distance learning, and wikis for collaborative projects in history of science.

**Isaac Record**, Institute for the History and Philosophy of Science and Technology

*The role of technological advance in the history of scientific practice*

Advances in technologies make new scientific practices first feasible, then acceptable, and finally standard. For example, the standards of explanation change as scientists adopt methodologies crucially dependent on particular technologies, for example, digital computers. This raises the worry that as scientists adopt new practices, they will admit corresponding explanations without any external validation. John Agar (2006) has satirized some histories of computing for representing computer development with these three steps: routinize existing mechanical methods; transfer the routine into computer programs at a time problems are tractable in either method; and finally, declare that the problem was intractable or impossible before computers. Agar's account is generally a good one, but his satire compresses decades of scientific practice and technological development into a semicolon. During those decades, computational tractability grew by leaps and bounds beyond the mechanical methods they replaced. Contra Agar, this difference is significant. In their work on the atomic bomb, Ulam, von Neumann, and Metropolis used computer aided numerical methods (Monte Carlo simulations) where analytic methods proved intractable and real experiments too dangerous or expensive (Galison 1997). So far, computers merely made practical what without them is very difficult. By the time these scientists moved on to the thermonuclear bomb, however, their reliance on simulation had passed beyond feasibility and acceptance – it was in fact necessary. I argue that enabling technologies constrains scientific practice and that helps shape the questions scientists ask and the standards by which they evaluate evidence and explanations.

**Brianna Rego**, Stanford University

*"Sediments of the Himalayas, Tailings of the Triumph Mine: Tracing Arsenic Through Mines, Mountains and Groundwater in the Bengal Delta and Central Idaho"*

As a result of the drilling of wells in the mid-1970s, Bangladesh found itself in the midst of a health crisis, millions poisoned by the toxic metalloid arsenic. By the 1980s, scientists had recognized the global gravity and implications of the situation, and as public health officials struggled with the crisis in Bangladesh, geologists and geomicrobiologists were researching the nature of arsenic contamination in the mountains and valleys of the American West, searching for ways to remediate the contamination. Arsenic occurs naturally in runoff and, from mountains to groundwater, has an inherent vertical element. In the mining regions of central Idaho the vertical migration of arsenic has an additional component as arsenic is found not only in groundwater but also in mine tailings, a remnant of the ore-mining days of the nineteenth and early twentieth centuries. Tracking this vertical migration from mines and mountains to groundwater (and tracing the geography of arsenic research) offers the opportunity to employ scientific and geographical methods in the study of the history of geology. Applying GIS technology, mapping and groundwater modeling techniques allows an integrated approach to the history of science that would not be possible through archival research alone. It is the aim of this paper to trace both the history of arsenic contamination in Bangladesh and the American West, and the history of geological research on arsenic during the late twentieth century, as revealed through the scientific literature and in the archives of the mining region of Idaho.

**Lynnette Regouby**, University of Wisconsin-Madison

*Man as Machine, Man as Plant: Analogies of the Body in La Mettrie's L'homme plante*

Participants in debates over materialism in the eighteenth century invoked specific conceptions of the body in order to argue their points of view. In his treatise *L'homme machine*, for example, the materialist Julien Offray de La Mettrie claimed to push the mechanist philosophy of Descartes to its logical extreme, arguing that animal and human bodies are machines and, further, that the soul itself is material. While *L'homme machine* is La Mettrie's most recognizable contribution to debates over materialism, his *L'homme plante*, written subsequently, frames an analogy between the bodies of plants and of humans, with strikingly different effects for concepts of the body. Incorporating recent developments in plant physiology by the "Harveys of botany," La Mettrie emphasizes analogies of function between parts of plant and human bodies. The crucial connection he posits between the environment and a plant's physiology opened up a space for incorporating the environment into conceptions of the human body as well. This paper explores the analogies between plant and human bodies in La Mettrie's *L'homme plante* both as a contribution to debates over materialism and mechanism in the eighteenth century and in order to locate the vital role botanical bodies performed in La Mettrie's conceptualizations of the body.

**Michael Reidy**, Montana State University

*From the Quarries to the Peaks: John Tyndall's Vertical Physics*

John Tyndall is acknowledged as one of the premier physicists and accomplished mountaineers in the nineteenth century, yet the relationship between his physics and mountaineering has yet to be examined. After receiving training in surveying and working as a railway engineer, Tyndall studied the magnetic properties of the earth's rocks, particularly the cleavage planes of slate, which in turn led him to similar studies on the fracturing of glaciers, work that relied heavily on arguments in thermodynamics. His work on glaciers and thermodynamics led him to further study the topic of radiant heat, particularly the manner in which atmospheric gases absorb solar radiation. This led him to his next research topic, the scattering of light by particles in the atmosphere, and to his now famous explanation of why the sky is blue and his equally famous contributions to the spontaneous generation debate. Note that Tyndall's scientific research programs took an obvious vertical orientation, from the ground up. As he practices his science, from rock quarries to glaciers to the study of the atmosphere, Tyndall's interests in the fundamental forces of nature brought him to the summits of mountains. Or, perhaps, as he climbed mountains, he found that he could more readily answer questions concerned with the very nature of physics. In either case, his science and mountaineering were tellingly mixed. As one of the leading definers and popularizers of his discipline, Tyndall's life and works suggest that physics was at least partly defined on the sides of mountains.

**Katherine Reinhart**, Johns Hopkins University

*Builders and Users: The Académie Royale des Sciences and the Construction of the Paris Observatoire*

In 1667 construction began on the Paris Observatoire, a building intended to serve as a home for the nascent Académie Royale des Sciences. Funded by Louis XIV, the structure was intended to provide space for the scientific activities of the academy including chemical laboratories, anatomy theaters, a library, natural history collections, and observatory equipment, as well as a venue to hold their general meetings. However, not a single general meeting was ever held at the Observatoire, and in fact, the space was never used by more than a handful of astronomers who themselves found the building ill-suited to their astronomical work. In the end, the grand edifice of the Paris Observatoire fulfilled few of its numerous intended purposes, and it failed to meet the expectations of those most closely involved in its design and construction. I argue that in its final configuration – both material and conceptual – the Paris Observatoire was the product of a contest between conflicting sets of interests held by two influential Académie members: its architect, Claude Perrault, and one of its primary users, Jean-Dominique Cassini. Each had influence over the design and construction of the building, and the Paris Observatoire became a space negotiated via disparate conceptualizations of its ultimate purpose. By examining images, artifacts, and texts from the founding of the Observatoire, I contend that the final configuration was the result of a negotiation that was variously dictated by professional experience, patronage relationships, and, most crucially, incongruent understandings of how best to achieve the ideal observatory: with an emphasis on form or on function.

**Christian Reiss**, Max-Planck-Institute for the History of Science, Berlin

*A curiosity becomes standard: On the Mexican axolotl's journey from 'nature' to scientific and popular 'culture', ca. 1860 – 1900.*

When discussing the question of place, the existing historiography of model organisms mainly addresses the integration of organisms into the experimental systems of laboratory science. The questions of how and where the animals and plants came from are mostly neglected. One of the reasons for this bias might be that model organisms became a topic in the life sciences only after the laboratory was already established as the site of a new biology. But there are a few organisms from a period, when the laboratory revolution was still in progress. In my talk I want to address exactly these questions by studying the introduction of the Mexican newt axolotl (*Ambystoma mexicanum*) to the laboratory. The axolotl was initially brought to Paris in the course of France's colonial activities in Mexico in the 1860s, but it soon turned from a curiosity into an object for experimental studies concerning evolution, ontogeny and physiology. This turn was due to a feature that became only fully visible in captivity – the axolotl's facultative metamorphosis. At about the same time, fanciers started to adopt the axolotl as one of the most popular "pets" for their aquariums, working in intensive exchange with scientists. This resulted in the axolotl's transformation into a cultural artefact that is today nearly extinct in its natural habitat but lives happily in labs and households all over the world. My talk will focus on this transformation and the discourses and practices involved in bringing the axolotl from nature to culture.

**Joan Richards**, Brown University

*The Logic of Women: Words and Reason in the World of Sophia De Morgan*

In 1863, Sophia De Morgan published one of the earliest Victorian discussions of spiritualism, in *From Matter to Spirit*. In this book, Sophia tried to explain, legitimate and understand her experiences with table turning, spirit writing and talking to the dead through mediums. Sophia brought a powerful family tradition of rationality to this endeavor: in 1793, her father William Frend, had been banished from Cambridge for his efforts to bring rationality into religion, and as she was writing, her husband, Augustus De Morgan, was devoting his life to teaching students to be rational through the study of mathematics and logic at the secular University College London. Both Frend and DeMorgan were absolutely central to the development of Sophia's ideas in *From Matter to Spirit* – her dead father was an important spiritual support to her endeavors; her living husband wrote the introduction to her book. But even as she tried to live up to the standards of the men she adored, in order to make sense of her world of women, children, and lower class mediums Sophia was forced radically to modify the views of rationality – of language, of mathematics, and of logic – they had developed in the rarified atmosphere of elite male education.

**Alan Richardson**, University of British Columbia

*Edgar A. Singer, Jr. and American Experimentalism: From Philosophy of Science to Social Science, 1930-1955*

There was a home-grown American school of philosophy of science that called itself “American experimentalism.” This school was anchored by Edgar Singer, was influential in founding and running the journal, *Philosophy of Science*, had important influence on the history of social science in America, and is now almost totally forgotten within philosophy of science. (This forgetting has occurred despite the fact that Singer’s colleagues and students edited *Philosophy of Science* from its founding in 1934 to 1990, with only a five year hiatus in the 1970s.) One reason it is absent from the canonical history of American philosophy of science is that its main practitioners often took their own advice and became social scientists. Singer’s two most dedicated students, C. West Churchman and Russell Ackoff, became leading theoreticians of operations research and systems science, helping to establish new social sciences within the auspices of engineering and business schools (together at Wayne University in the 1940s; Churchman then went to Berkeley’s Business School; Ackoff went back to Penn and became one of the leading members of the Wharton School of Business). This paper briefly re-introduces the school, relying on programmatic statements and activities by Ackoff and Churchman in the 1940s and 1950s. It aims to help complicate our understanding of philosophy of science in America during the alleged dominance of logical positivism and to explore ways in which American philosophy of science helped create new social scientific configurations in the period after World War Two.

**Jesse Richmond**, University of California, San Diego

*Le Gros Clark vs. Zuckerman: Reckoning Ancestry and Expertise in Post-war Paleoanthropology*

In the late nineteen forties, the tide of scientific opinion began to shift in favor of the view that the Australopithecines, extinct ape-like creatures known from fossils discovered in South Africa over the last two decades, were closely related to human beings and possibly even direct evolutionary ancestors. The Oxford anatomist W.E. Le Gros Clark had recently become converted to this view after travelling to South Africa to study the fossils, and he used his well-connected position in the network of British and international science to promote humanity’s Australopithecine ancestry. However, he was challenged by another scientist, Solly Zuckerman, who accused Le Gros Clark of failing to employ modern biometric techniques in his studies. Zuckerman argued that by using rigorous statistical analysis to compare measurements of the Australopithecine fossils to measurements of the homologous parts in modern humans and apes, he had demonstrated that there was no scientific basis for believing that the extinct creatures were more closely related to humans than to apes. The disagreement precipitated a bitter and prolonged contest, carried out in a number of forums, including museums, scientific journals, and private correspondences. At stake throughout was an ambiguous combination of scientific knowledge, method, and credibility, all woven together in the actions and rhetoric that made up the controversy. This paper follows the interweaving of these threads, seeking thereby to demonstrate the interdependence of natural, technical and social relations in the early history of post-war paleoanthropology.

**Marsha Richmond**, Wayne State University

*Bateson’s Pre-Mendelian Study of Variation and Heredity*

William Bateson (1862-1926) is best known for the leading role he played after 1900 in championing Mendelism as the paradigmatic approach to understanding heredity. Less well studied is Bateson’s earlier decade-long research program on variation – a search for the causes leading to organic variation as a contribution to evolution studies. The present paper examines Bateson’s pre-Mendelian study of variation by considering his debt to Darwin, the impact of Galton’s theories on shaping his rejection of neo-Darwinian assumptions, and the experimental investigation of variation he carried out after 1894 in an attempt to provide support for his unorthodox views. By evaluating the theoretical and methodological context of Bateson’s pre-1900 work, this paper aims to provide a clearer understanding of his subsequent Mendelian research program. More generally, it hopes to shed light on how a marginal line of work in evolutionary biology in the 1890s expanded after 1900 into a viable, attractive, and mainstream research program characterized by a new hereditary synthesis arising out of key intellectual convictions and calculated social and empirical strategies.

**Stefan Rieger**, Ruhr-Universität Bochum

*Psychocybernetics in 20th century USA*

The paper tries to stress a certain type of argument about the cybernetics of human behavior and, connected with this, a special material: so-called programs or prescriptions. What I have in mind deals with texts, which are able to influence, to modify, to create future behavior – in short, genres which program subjects. The title I have chosen for my paper names such a model for human engineering: psychocybernetics, a concept that was and still is extremely popular in the United States. The crucial point I’m interested in is the difference between describing and prescribing. This difference deals with agency. Who is the actor within the concept of self-control, of feedback loops, of self-programming? What kind of subjectivity accompanies this idea of people who program, control, improve themselves based on the prescriptions of certain programming textbooks and who are driven or motivated by their own volition, their own so-called free will? What are the cultural consequences for such a concept of cybernetics? In a concept such as psychocybernetics nobody can tell the difference between the programmer and the object being programmed. To be more precise: The difference between subject and object begins to blur. This blurring is an effect of the complexity of both psychic and social systems. In concepts such as self-organisation, self-control and feedback we can observe this specific mode of enhanced complexity; in concepts such as psychocybernetics we can observe the consequences for the subjects concerned.

**Lukas Rieppel**, Harvard University

*The Ancient Land of Sheba: Value and Exploration in Early 20th Century America*

American natural history museums mounted some of the largest and most ambitious scientific expeditions during the first decades of the 20th century. My paper explores the culture that motivated these expeditions and shaped the assumptions underlying their execution. To do so, I examine the place that Ethiopia occupied in the imagination of early 20th century explorers. Ethiopia had long held a special place in the Western imagination, in part because many of its inhabitants practiced an ancient form of Christianity but also because it successfully rebuffed Europe’s colonial ambitions until well into the 20th century. During the 1920s, both the American Museum in New York and the Field Museum in Chicago mounted separate expeditions to Ethiopia. The Field Museum crew set off to Africa in search of natural history specimens such as the elusive and then little-understood Mountain Nyala. In contrast, Barnum Brown, who was a curator at the American Museum, traveled to Ethiopia as a consultant for the Anglo-American Oil Company in search of large-scale petroleum reserves. Although the two expeditions look rather different at first sight, I will argue they share a deep continuity. It is this continuity that allows us to recover some of the values governing voyages of exploration in early 20th century America.

**Jody Roberts**, Chemical Heritage Foundation

*Making Sense of Human Biomonitoring Studies: The Evolving Politics of Communicating Exposure Results by Governments, Industries, and NGOs*

Human biomonitoring, or the analysis of human tissue and fluids for the presence of a chemical, has evolved over the past half century from a tool used to monitor worker exposure into a feature of public health monitoring. The change in context from work to home – or from the professional to the personal – has compounded the complications in communicating the results of these studies. Or, to put it more bluntly, it is one thing to inform a worker exposed to lead in the workplace that lead can indeed be found in his blood; it is another to inform an “average” citizen that nearly 300 synthetic chemicals can be found in her blood and urine. In this paper, I compare the ways in which the results of human biomonitoring are communicated by three separate groups – government agencies (such as the EPA and more recently the CDC), industry trade groups (such as the American Chemistry Council), and NGOs (such as Environmental Working Group and Commonweal) – and compare these tactics with those used in previous decades when the nature of the science was more narrowly tailored to understanding exposure in a circumscribed place and time (i.e., at work). An examination of these three groups highlights the political nature of communicating scientific information, especially when the knowledge associated with that information is uncertain, incomplete, and contested.

**Nils Roll-Hansen**, Department of Philosophy, Classics, History of Art and Ideas

*Johannsen's Genotype Theory and his Critique of Darwinism*

In his bean selection experiment, published 1903 in *Erblichkeit in Populationen und in reinen Linien* (*Heredity in populations and pure lines*), Wilhelm Johannsen (1857-1927) deliberately chose a self-fertilizing species. It was known that in self-fertilizing species the individuals descending from one parent were especially similar, they belonged to the same biological type. Johannsen called such populations “pure lines” and he saw them as representing “elementary species.” The absence of any effect of selection within the pure lines surprised Johannsen himself. It sharply contradicted the current Darwinian idea that generally present continuous hereditary variations are the basis for evolution of species by natural selection. The result led Johannsen into long-lasting controversies with biometricians and other orthodox Darwinian selectionists as well as with neo-Lamarckians. The terms “genotype,” “phenotype” and “gene” were introduced in his classical treatise *Elemente der Exakten Erblichkeitslehre* (*Principles of an exact theory of heredity*) in 1909 as part of his attempts to formulate a new Darwinism consistent with the recent new knowledge about heredity, Mendel's laws, the stability of elementary biological types, etc.

**Sophie Roux**, Université Grenoble II/ Institut Universitaire de France

*The limits of thinking with machines: the problem of percussion*

The early unpublished Galilean treatise *On mechanics* (ca. 1600) includes a chapter on the force of percussion. In this chapter, Galileo tries to apply to the force of percussion the principle of compensation between distances and weights that he discovered for simple machines like the balance and the pulley. Of course, he does not succeed. In the first part of my talk, I shall explain why in the first place he tackled the problem in this way: how the force of percussion was constructed as a physical phenomenon, why he dealt with it in a treatise on simple machines, and what kind of explanations this strategy entails. In the second part of my talk, I would like to explain some later hesitations of Galileo about percussion. Indeed, Galileo performed some experiments and he reached the conclusion that the force of percussion is indeterminate (it varies according to the resistance to which it is applied) and infinite (the smallest body has an effect on the biggest body that it percutes). Nevertheless, in the unpublished *Sixth Day of the Discourses on two new sciences*, he continues to entertain, albeit intermittently, the hope that percussion can be reduced to a machine. In the third and last part of my talk, if time permits, I would like to give a few indications showing that Descartes dealt with the problem of percussion in a quite different way, even though machines in general and balances in particular were still present in his works.

**Paul Rubinson**, University of Texas at Austin

*An Elaborate Way of Committing National Suicide”: Carl Sagan, Popularization, and Nuclear Winter*

In 1983, astronomer Carl Sagan announced the nuclear winter theory: that nuclear war would trigger a climatic disaster. Dust, smoke, and soot would create “an unbroken and deadly gloom” that could freeze the Earth. “Most of the human survivors would starve,” Sagan asserted. Sagan's talents as a science popularizer ensured that nuclear winter captivated the public, partly because of Sagan's conspicuous efforts to subject nuclear winter to scientific criticism far beyond peer review. “Nuclear winter,” one scholar told Congress, “is quite unprecedented in the credibility and explicitness of its apocalyptic speculations.” Reagan administration opponents used the theory to challenge nuclear deterrence, though nuclear winter also inspired resistance. Many scientists objected not to nuclear winter but to Sagan's public presentation of it, believing that using science to support political arguments tainted Sagan's results and even science itself. *Nature's* editor wrote about nuclear winter: “it seems to me improper that the results of calculations should be published even in sober language without a warning to all potential readers of the pitfalls . . . This is doubly unfortunate when, as on this occasion, a purportedly scientific publication is so fully amplified by popular articles.” While nuclear winter may have been a scientific veneer for Sagan's antinuclearism, recent research has in many ways confirmed the theory. But at the time, Sagan's failure to adhere to the conservative mores of science cost him credibility. While Sagan believed that science spoke urgently to society, many scientists asked him to keep quiet, arguing that science should not actively seek political influence.

**Lisa Rumieli**, York University

*“Sex and Death in the Rational World” of Scientist Activists: The Activism of Union of Concerned Scientists from 1980 to 1986*

In her article, “Sex and Death in the Rational World of Defence Intellectuals,” Carol Cohn shows how the defence community's discussions of nuclear war were abstracted from the very real human impact such a war would have. This was not only a requirement of defence intellectuals: scientific experts, who had an increasingly large role in the American government after the Manhattan Project, also adhered to this detached way of discussing nuclear war. Indeed, this practice was reinforced by the credo that a scientist must remain objective and impartial towards their subject of analysis. This paper examines the activism of Union of Concerned Scientists (UCS) between 1980 and 1986 to show how pervasive scientific stereotypes about objectivity and impartiality also influenced the shape of UCS's activism. While UCS was undoubtedly an active and influential group in the anti-nuclear movement during the 1980s, the organization was cautious about the degree to which they associated with this larger movement of concerned Americans. I will argue that it was UCS's scientific identity and desire to be taken seriously by their scientific peers that influenced the activist group's conservatism. Indeed, the background of most key UCS members in either physics or engineering gave them an advantage because they spoke the same sanitized, technological language as government proponents of nuclear technology. As a result, however, the group's discussions of nuclear power and nuclear weapons were generally out of touch with the very real fear and outrage they inspired in so many people.

**Alexandra Rutherford**, York University

*Putting Behavior in its Place: The Sites and Spaces of Behavior Modification, 1950s-1970s*

There is a large literature by historians and sociologists of science on how, as Golinski puts it, “laboratory- made knowledge” emerges into the world outside. Much of this literature has focused on the rhetorical, discursive, and social processes that govern this transition. By contrast, in this paper I focus on the actual physical sites and spaces where a particular form of highly localized scientific practice found its way out of the laboratory. Specifically, I examine how the experimental methodology of psychologist B. F. Skinner, developed in the operant chambers of the Harvard Pigeon Laboratory in the basement of Memorial Hall in the 1950s, was re- imagined and recreated at multiple physical sites over the ensuing two decades. Using Charles Ferster’s work with autistic children in experimental rooms at the Indiana University Medical Center, Harold Cohen’s work with incarcerated juvenile delinquents at the National Training School for Boys in Washington, DC, and the behavioral community of Los Horcones in Hermosillo, Mexico, I argue that the physical design of the operant chamber exerted a powerful and perhaps even constitutive influence on the development of a technology of human behavior as it emerged into the world outside. This emergence depended crucially on the availability of sites and spaces with particular physical specifications that allowed behavior modifiers to construct analogues of the operant chamber, but with certain variations determined by the practical tasks at hand. I suggest that the sites and spaces of behavior modification were thus neither incidental nor insignificant in its “flight from the laboratory” (Skinner, 1959).

**María Jesús Santasmases**, Consejo Superior de Investigaciones Científicas (CSIC)

*Heredity in the clinic: early cytogenetics from London to Madrid, 1956-1966*

Heredity in the clinic: early cytogenetics from London to Madrid, 1956-1966 For tracing a genealogy of human cytogenetics in a Spanish clinical setting (a unit of cytogenetics at the Fundación Jiménez Díaz in Madrid) I will present the origins of human karyotyping followed by the early works on karyotypes in the Paediatric Research Unit head by Paul Polani at Guy’s Hospital in London. I will intertwine my story with reference to visual cultures of karyotyping so as to show the construction of the crafting of the early days of human medical genetics. My aim here is to put into the historical map of human genetics not only the origins of these practices and the role played by visual cultures but also the paths through which techniques, methods and ways of reasoning circulated.

**Lily Santoro**, University of Delaware

*Creation and the Natural World: The Popularization of Science During the Second Great Awakening, 1776-1840.*

Between 1776 and 1840, Americans experienced two key cultural shifts—the rise of evangelicalism and the popularization of the natural sciences. American popular culture celebrated the use of the natural sciences of the age – astronomy, geology, mineralogy, and natural history – to understand God’s created world. Through a growing print culture, an increasing number of Americans encountered scientific understandings of the natural world in magazines, textbooks, almanacs, and newspapers. Meanwhile, the young nation also witnessed a period of religious revival and growing theological debates. In a period in when Americans became more deeply wedded to their bibles, they were exposed to new “scientific” ways of viewing God’s creation. This paper will explore where Christian Americans encountered these two approaches to the natural world, and how they balanced them. Drawing on the work of David D. Hall and others on the history of “lived religion” in America, this paper will explore how the popularization of the natural sciences influenced the lived religion of Christians in the early republic. How did average churchgoers of differing denominations view the relationship between the biblical and scientific accounts of the natural world? To address this question, I will investigate how the relationship between the natural sciences and religion was presented in popular Christian publications and periodicals, many of which included regular columns on “Science and the Arts.” Then, I will look at the writings of a sample of Christians – lay churchgoers, students, and pastors – to get at how pastors and their congregants understood this balance.

**Voula Saridakis**, Lake Forest College

*Collaborators or Competitors? The Astronomical Correspondence of G-D Cassini and John Flamsteed*

Correspondence among intellectuals in the late seventeenth century was a means for exchanging ideas and sharing news of the most recent discoveries and technological inventions. This exchange of letters often drove fierce competition as much as it encouraged collaboration, as in the case of correspondence among intellectuals associated with the Paris and Greenwich Observatories during that time. Despite the views of his contemporaries and competition between French and English astronomy, John Flamsteed, the first Astronomer Royal of the Greenwich Observatory, established a cordial and open correspondence with his French counterpart, the Director of the Paris Observatory, Giovanni Domenico Cassini. In this paper, I describe how their correspondence reveals their mutual respect for one another’s abilities despite the fact that their observations and calculations frequently differed. It was not as important that their observations and measurements matched exactly, but rather that their methods of observation, support and use of new instrumentation, and enthusiasm for the study and promotion of observational astronomy were similar. Their correspondence reveals how observational astronomy was emerging as a scientific discipline in which instrumentation and methods of observation were becoming more essential than specific differences in observations and measurements.

**Tom Scheiding**, Elizabethtown College

*The Influence of the Chemical Foundation on the Research and Scholarly Communication Process in Physics and Chemistry*

The research conducted on the Chemical Foundation thus far has been devoted to chronicling the Foundation’s seizure of German chemical and dye manufacturing patents, the federal government’s later attempt to repatriate these patents, and the overall impact of the Foundation on the development of the chemical and dye industry within the United States in the 1920s and 1930s. Little noted however is the significant impact the Chemical Foundation had on altering the financial and organizational structure of the research process in physics and chemistry and the publication of this research in scholarly journals. Using the archival records of the Chemical Foundation, we trace out the influence wielded by the Chemical Foundation (and more specifically, by the Foundation’s founder, Francis Garvan, and the Foundation’s business manager, William Buffum) on the research agenda and scholarly communication process in chemistry and physics in the interwar period. What we find is that while the Chemical Foundation made great strides in providing the resources that allowed each discipline’s scholarly societies to centralize their publishing and business operations and realize cost efficiencies, the Foundation struggled to foster cooperation among the two physical sciences.

**Samuel Schindler**, University of Leeds

*Photo #51, the CCV theory, and the Discovery of the DNA Structure*

In most popular and in some scholarly accounts of the discovery of the DNA structure by Crick and Watson in 1953, one finds the following claim: Crick and Watson used data that Rosalind Franklin had obtained in her research at King's college and those data were critical in the discovery on the DNA structure. Although it is correct that Crick and Watson used Franklin's data, I want to show in this paper that this information was not sufficient for making the discovery. I want to argue that the so-called CCV theory of helical x-ray diffraction (devised by Crick, Cochran, and Vand) was necessary for interpreting the x-ray evidence, which Franklin had produced, in the right way. Franklin, who had no knowledge of this theory, showed her lack of understanding of the now almost iconic "Photo 51" of the B form of DNA by leaving it in a drawer for several months before handing it over to her arch enemy Wilkins, who then passed it on to Watson in January 1953. What is more, Franklin in July 1952 even wrote a death note for the helix after she was confident to have produced a pattern that ruled out a helical structure. Crick and Watson, in contrast, described the latter picture as "spurious", not by giving any explicit reasons why they thought it was, but rather, as I want to claim, on the basis of their belief in the correctness of the helical structure, which was mediated by the CCV theory.

**Judy Schloegel**, Independent Scholar

*The Pragmatist's Path: Herbert Spencer Jennings and the Study of Heredity, Variation, and Evolution*

While Herbert Spencer Jennings (1868-1947) contributed to diverse areas of biological research including embryology, animal physiology, and animal behavior, he is generally remembered as a geneticist who contributed significantly to the institutional establishment of genetics in the United States. Although some of his theoretical publications have made it reasonable to assume, as many have done, that Jennings was an enthusiastic Mendelian, consideration of his experimental research program in heredity reveals a different story. This paper argues that the lens through which we can best understand Jennings' research in genetics is that of pragmatism. While his investigations supported aspects of Mendelism, at the same time he aimed to challenge experimentally many of the implications of Mendelism. This presentation will explore the intellectual and cultural milieu broadly associated with the philosophy of pragmatism that nurtured Jennings' investigations of heredity circa 1910. It will examine Jennings' experimental studies of heredity, variation, and evolution in protozoa along with the diverse pre- and non-Mendelian intellectual resources – including the systematic philosophy of Herbert Spencer, the deliberations of evolutionary psychologists such as C. Lloyd Morgan, the pragmatist thought of William James and John Dewey – and investigations of other immediate post-1900 experimental students of heredity that informed Jennings' research program. This paper argues that it is appropriate to place primary emphasis on Jennings' little-known experimental research program when considering his broader representation of heredity, variation, and evolution, because, as a practitioner of pragmatism, Jennings believed that experimental practice was the basis of all inquiry.

**Martina Schlünder**, Institute of Medical History/University of Giessen

*Between Alps, Operating Room, Stable and Laboratory: a Topography of Sheep in Modern Trauma Surgery (1960-)*

In 1958 the AO (Arbeitsgemeinschaft für Osteosynthesefragen/Association for the Study of Internal Fixation) was founded by a group of Swiss surgeons who introduced osteosynthesis - operative fracture care with metal implants into surgical routine treatment instead of treating fractures with casts, extension, and immobility. Osteosynthesis relied on a different epistemic concept of bone healing. Although they had a wealth of clinical experience the AO-surgeons were not part of academic surgery. Organizing their own scientific infrastructure the AO founded a research laboratory in Davos in the Swiss mountains outside any university facility. In the 1960s the AO started with experimental surgery in rented rooms and with rented laboratory animals: sheep bred as livestock in large numbers in the mountains around Davos. After a surgical experiment sheep were taken back to their flocks in the mountains. The mechanical testing and the stability of the fracture care were thus performed in the "natural laboratory" of the alps and the surgeons sought the sheep there before bringing them back to the research institute for every follow-up check. My paper will show how in the course of 30 years this "Wild Sheep Chase" was transformed into one of the most modern research facilities of trauma surgery: a sheep pen with standardized interior climate and standardized animals, bred only for the purpose of experiments and how sheep – ruminants and herbivorous animals – became more or less accidentally the standard animal model for human bone healing.

**David Schmit**, College of St. Catherine

*Mesmeric Science in the Mid-Nineteenth Century*

Amidst mesmerism's colorful and controversial history lies an unappreciated story of how the practice stimulated advances in the methodology of psychological inquiry. The core of mesmeric practice, that inducing a person into trance altered thinking, feeling, and bodily functions is the seminal "experimental" event from which mesmeric science develops. In the prototypical mesmeric investigation of the 19th century, a classic "before and after" methodology was practiced. Controlled manipulations were enacted by assessing subjects prior to trance (while in a "normal" state), during trance (when subjects might display mind-body phenomena and inexplicable behaviors), and after trance, when treatment outcomes could be appraised. This model formed the pretext for countless "scientific" investigations of mesmerism. With these pioneering "experiments," the mesmerists demonstrated mind-body linkages which were subversive to elite Europe's fragile soul-body bifurcation established between theologians and mental philosophers on one hand, and secular empiricists, sensationalists and materialists on the other. Less appreciated are changes in methodology after mesmerism was transported to the U.S. in 1836. In the hands of orthodoxy-rejecting Jacksonian Americans, rough-hewn efforts to uphold scientific legitimacy through consensual validation of results and rudimentary attempts to reduce experimenter effect were enacted. The methodology of mind-body research took a remarkable step forward with the 1837-1842 mesmeric investigations of John Kearsley Mitchell. Whereas mesmerism has been recognized as influential in the development of psychotherapy and treatment of mental illness, little has been written about its contributions to the development of scientific psychological methodology. This paper aims to expand our understanding of this history.

**Robert Schombs**, Cornell University, *Burning Questions: Justus Liebig on Spontaneous Human Combustion*

On June 13, 1847, the remains of the Countess von Görnitz were found in her Darmstadt room, severe burns localized around her head and upper torso. The telling characteristics – no obvious ignition source, a room covered in a unctuous, noisome soot, a strangely localized fire – seemed to indicate to some physicians on the scene a diagnosis of “spontaneous human combustion.” Over 40 cases of such a malady, often affecting old and overweight women with a fondness for alcohol, were documented in the forensic medical literature; spontaneous human combustion enjoyed the status of a legitimate “disease.” Later, however, suspicions were raised that John Stauff had robbed and assassinated the Countess. A trial for murder resulted, and the debate raged: was the Countess’s death another case of spontaneous human combustion, or was it simple murder? Justus Liebig, the preeminent organic chemist, was called as an expert witness to help the court arrive at an answer. Liebig’s testimony damned spontaneous human combustion, John Stauff, and to some extent the autonomy of medicine and physiology from chemical theory. John Heilbron’s paper on the Görnitz incident (1994) focuses primarily on the “new authority” of the testimony of academic scientists. My aim in this paper is to use the Görnitz incident to explore Liebig’s boundary making between chemistry, physiology, and medicine and explore the historical, social, and cultural meanings of spontaneous human combustion. Curiously drawn into the Görnitz case, Liebig was provided with the opportunity to act not only as Stauff’s judge but as the judge of the ability of physiology and forensic medicine to operate without input and guidance from chemistry. By showing the dependence of such disciplines on the more fundamental principles of chemistry, Liebig, who William Brock calls the “Chemical Gatekeeper,” could support his larger project of crafting chemistry into a “central science.”

**Anne Secord**, University of Cambridge

*Nature’s “rejectamenta”: seaweeds and the scientific observer*

In the late eighteenth century marine plants were as strange and unknown to most botanists as the newly discovered Australian flora, for the sea and its productions were largely unexplored. Botanists studying seaweeds were warned to lay aside “all comparisons and ideas of analogy taken from plants growing on land,” since the marine algae presented a baffling series of transformations in their modes of existence for which it was “not easy to account on philosophical principles.” Moreover, knowledge of seaweeds had to be built up from glimpses – sometimes of only battered, hard-to-recognise specimens picked up on beaches among the “rejectamenta” of the sea. Early seaweed studies, which involve observers confronting the unfamiliar or unexpected, reveal more clearly the processes of scientific observation, especially during the Napoleonic Wars when religious and political conservatism was reflected in attitudes to nature and family. The views of Continental naturalists such as Reaumur were dismissed as “speculative and unfounded theory,” rather than “actual observations resulting from a series of experimental discoveries.” Yet, a science based on glimpses and fragments could allow observers to enter into a complete view only through the imagination. The difficulty of classifying seaweeds appears to have led British botanists to reject system, in favour of a cautious empiricism based on visual confidence (as displayed in spectacular depictions of beautiful natural objects) and on taxonomic anxiety born out of concerns with the moral ugliness of natural beings that did not readily fall into natural families.

**Ioanna Semendeferi**, University of Houston

*Regulating ALARA--As Low As Reasonably Achievable? Health-Physics Practice and Profession*

The field of health physics emerged during the Manhattan project. The term health physics was coined because of wartime secrecy: Health physicists ensured radiation safety. At the turn of the 1970s, publicity over the possible cancer effects of low-level radiation from civilian nuclear-power plants led to a watershed in the regulatory process. ALARA became regulation in radiation protection. ALARA was the regulatory expression of the controversial linear non-threshold radiation model. The model postulated that any amount of radiation, however small, could damage human health. ALARA, and its implicit no-safe level principle, represented a great defeat for the nuclear-power industry and brought sweeping changes in health-physics practice and profession. What did ALARA actually mean and how could a health physicist implement ALARA? How low was reasonably achievable? Because of its unclear meaning, ALARA became open to local interpretation, negotiation, and litigation. It brought enormous difficulties in every day health-physics practice and precipitated professional and ethical dilemmas. Its implementation confronted health physicists with accusations of negligence to public health from one side and wasteful overprotection from the other. Radiation safety, which was the health physicists professional objective, became a contradiction in terms. Initially, ALARA created new professional opportunities for health physicists. Over time, however, ALARA brought uncertainty in the health-physics profession and decelerated its pace of growth. The interplay of ALARA and health physics, a field immersed in scientific uncertainty and political conflict, brings to the fore the issues of silence, suffering, and survival in scientific endeavors.

**Minwoo Seo**, Seoul National University

*Mediating models and machines: John Smeaton and Interactions between Natural Philosophy and Engineering in 18th-century Britain*

This paper examines the natural philosophical and engineering practices of John Smeaton (1724-1792), a very well-known 18th-century British civil engineer, with an aim to illuminate multifaceted interactions between natural philosophy and engineering in 18th-century Britain. This paper will first examine the popularization of Newtonian natural philosophy as socio-cultural contexts of Smeaton’s waterwheel models and other machines, as well as widespread interests in the motive power of machines and human labor. It will then discuss how J. T. Desaguliers’s maximum machine was constructed in these contexts, and how this machine had an influence on Smeaton in devising his famous waterwheel model in 1759. Finally, it will explore Smeaton’s subsequent experiments with various new machines between 1776 and 1782, and his conflicts with contemporary Newtonian natural philosophers such as Isaac Milner at Cambridge over the nature of Newtonian force and vis viva. My paper will cast new light on three interrelated issues in the history of 18th-century natural philosophy and engineering. First, unlike previous historical studies that largely ignored Smeaton’s inclination to natural philosophy, it will emphasize the important role of natural philosophy in making his models and machines. Second, this paper will demonstrate a mediating role of models and machines between natural philosophical and engineering practices. Finally, by examining Smeaton’s practices from his making of waterwheel models through subsequent machines to his debates with Newtonian philosophers, it will present a more balanced picture of Smeaton as a philosopher-engineer who lived in a society which had just begun to be industrialized.

**David Sepkoski**, University of North Carolina Wilmington

*The “Species Concept” and the Growth of Paleobiology*

The modern evolutionary synthesis shifted biologists’ attention to the dynamics of gene flow within populations, producing a concept of the biological species that was “populational.” This, however, posed a problem for paleontologists interested in contributing to evolutionary theory: fossils leave no record of genetic information, and it is notoriously hard to reconstruct assemblages of fossils that correspond to living populations. So how could paleontologists accommodate the idiosyncratic evidence of the fossil record to the increasingly precise resolution expected in the growing field of population genetics? One strategy was to attempt to redefine the very notion of the “paleontological” species. Debates carried out in the journals *Evolution* and *Journal of Paleontology* in the early 1950s show considerable divergence of opinion among evolutionists about whether the term “species” meant the same thing in both paleontology and neontology. I will argue however, that the solution to the paleontological “species problem” ultimately came not from arguments about definitions but from a new methodological approach: a handful of paleontologists, led by the American Museum invertebrate specialist Norman Newell, began to develop statistical, quantitative methods for evaluating and interpreting fossil populations. This approach was important for three reasons: it posed a solution to the problem of incorporating “population thinking” into paleontology; it introduced greater analytical rigor (of the type increasingly expected in mathematical population biology) into paleontology; and finally, it introduced new theoretical possibilities for interpreting the evolutionary significance of the fossil record that contributed to the further growth of evolutionary paleobiology.

**Suman Seth**, Cornell University

*Heisenberg’s Observables and Sommerfeld’s “Lawful Regularities”: Re-thinking the Methodological Origins of Matrix Mechanics*

Late in his life, Werner Heisenberg recalled an interaction with Albert Einstein over the theory of matrix mechanics put forward in the mid-1920s. Heisenberg was astonished to discover that Einstein did not agree with his focus on the construction of a quantum theory based solely on observable quantities. Einstein “thought that every theory in fact contains unobservable quantities,” Heisenberg remembered. When the younger scholar pointed out that he had “merely been applying the type of philosophy that he [Einstein] had made the basis of his special theory of relativity,” Einstein simply retorted: “Perhaps I did use such philosophy earlier – but it is nonsense all the same.” Heisenberg, it will be noted, drew well back from citing the Machian phenomenology of Einstein’s 1905 paper as a direct resource for his rejection of non-observable quantities in the development of a quantum mechanics, suggesting only that Einstein’s work was part of a “type” of philosophy. Many later commentators, however, have been less reticent and it is now a relative commonplace in the literature to find Einstein’s early methodology referenced as a crucial model for Heisenberg’s iconoclastic approach. This paper suggests that a far more proximate resource may be located in the practice of theorizing advocated by Heisenberg’s first teacher and mentor in the arcana of the older quantum theory: the Munich theoretician Arnold Sommerfeld. From the end of the First World War until the introduction of Schrödinger’s wave mechanics in 1926, Sommerfeld increasingly advocated an abandonment of searches for Modellmessig [model-based] explanations of the complexities involved in the analysis of the Zeeman Effect and X-Ray spectra. Instead, he and his school, including Heisenberg, pushed for a direct engagement with extensive data on the positions and intensities of spectral lines in order to uncover the Gesetzmäßigkeiten [lawful regularities] underlying “the music of the spheres within the atom.” Taking as granted Michel Janssen’s recent work on the roots of the technical content of Heisenberg’s Umdeutung [re-interpretation] of classical concepts, this paper thus draws on insights first suggested in David Cassidy’s work on Heisenberg’s “professional style” to trace a genealogy of method connecting the “revolution” of quantum mechanics to the “craft of the quantum” advocated by one of the masters of the older quantum theory. The result is a new understanding of not only the origin, but the meaning of the phenomenalism introduced and promoted in one of the most significant papers of twentieth-century physics.

**Adam Shapiro**, University of British Columbia,

*Race and Creationism in Europe*

In September, 2007, the Council of Europe Parliamentary Assembly issued a resolution condemning the teaching of creationism. While it rejected both Christian and Islamic expressions of antievolution, the timing of the resolution coincided with the widespread distribution of the *Atlas of Creation*, a book described by the resolution’s author as “an offensive by the Turkish creationist Harun Yahya.” It appears from the text of the resolution that Yahya’s organization was a primary target of the Council. The timing and rhetoric of this resolution suggest that European attitudes towards creationism are undergoing a significant shift. Long considered an American affectation, (even though creationism had been present in Europe since Darwin’s day) it appears that antievolution is being treated as a serious threat at the same moment that it has become represented by a Turkish and Muslim incarnation. This suggests that the debate over creationism in Europe may take on overtones of race and should be viewed in light of the larger debates over immigration and education in European identity. Claims that “creationism could become a threat to human rights” also link antievolution to rhetoric that has been central to the issue of Turkey’s integration into Europe. This paper will argue that recent European creationism may be better understood in the light of these racial politics, particularly those focused on compulsory education. Viewing creationism in Europe as essentially similar to that seen in the United States may fail to get at the source of these new controversies.

**Grace Shen**, York University

*A Glacial Reception: Li Siguang, Quaternary Geology and Politics of Scientific Persuasion*

While most historians of science are familiar with the controversy surrounding Louis Agassiz’ proposal of a great ice age, the ongoing debate surrounding Li Siguang’s theory of widespread Quaternary glaciation in central and eastern China is largely unknown. Li’s first suggestion of glacial action in Hebei province came in 1922, and over the next half century the hypothesis expanded to cover most of the low-lying mountains of China proper. From the outset, Li’s ideas on glaciation encountered vigorous opposition in both local and foreign scientific circles, but by the 1950s and 60s, they had defied almost unanimous dismissal by international geologists to become the established orthodoxy in the People’s Republic. On the surface, what was at stake were global paleoclimatological issues, the origin of China’s vast loess deposits, mammalian dispersion in Asia, and fundamental questions of mountain-building worldwide. However, the fortunes of Li’s theory of Quaternary glaciation turned on matters of not only evidence and expertise but politics and performance. My talk examines four phases along the trajectory of this geological idea from China’s Republican period (1911-49) to the Communist era (post-1949), and uses the interplay of theory and fieldwork to place the construction of geological authority within its larger context of establishing science in China and establishing China within international science

**Kathleen Sheppard**, University of Oklahoma

*Serving the Empire: Nineteenth-Century Women Archaeologists in the Field*

Nineteenth century archaeology in Britain is a male-dominated field, and histories abound with heroic tales of exploration, discovery, and the imperial mission. Recently, scholars have been writing more about women in archaeology, but these works are more about including women in the narrative than they are about analyzing their activities. Some historians argue that women dealt with and had to work around unresolvable tensions between their lives as British middle class women and their lives as archaeologists. Using Gertrude Bell's work in Iraq and Hilda Petrie's work in Egypt, this paper will evaluate the varied ways in which these two archaeologists interpreted their roles as women and as professionals in the late nineteenth and early twentieth centuries, and how that led to the distinctive ways in which they filled them. I argue that women were agents not only in furthering the empire but also in professionalizing the discipline of archaeology in Britain.

**Jonathan Simon**, Université Lyon 1

*Standardization and the history of the medical sciences*

From containers to electrical plugs, it is difficult to imagine certain sectors of the economy operating in the absence of national or international standards. This rise of standardization raises many interesting questions for historians and philosophers of science and technology as well as historians and philosophers of business and industry. Are standards a way to help or to hinder competition? Is standardization a rational response to modern economic development (globalization versus glocalization)? Are there valid reasons (economic or ethical) for resisting the imposition of such standards? Drawing on writings from cultural sociology and economics as well as the history of physics and technology, this paper explores the issue of standardization in the medical sciences in the twentieth century. The work on the standardization of electrical resistance and its relationship to projects in communication of great economic importance is well known. We ask whether there is a similar history to be told in the medical sciences concerning the interplay of business interests and scientific developments in the field. Starting with a reflection on the practices of quality control in the pharmaceutical industry and its relationship with government concern for public health, we will broaden our analysis to consider standardization as it applies to medical diagnostics, imagery and treatment. Thus, we will open various avenues running from the paradoxes and contradictions of the efforts to standardize sera at the end of the nineteenth century to the need to rally around science-based medicine and establish consensus in clinical treatment a century later.

**Mark Solovey**, University of Toronto

*Harry Alpert's Adventure on the Endless Frontier: What Is This Thing Called Social Science?*

Sociologist Harry Alpert's claim to fame in the history of the social sciences lies in his effort as head of the young National Science Foundation's social science program to construct a viable policy framework for supporting this controversial area of study. Historical scholarship has emphasized that Alpert faced a variety of ideological, political, and institutional pressures during the mid-1950s that led him to promote the social sciences as part of a unified scientific enterprise and as junior partners to the more established and rigorously scientific natural sciences. But the historical literature tells us little about Alpert's own views. In this paper I examine Alpert's struggle to answer the basic question "what is social science?" Alpert had a deep interest in the acrimonious debate over this question and the associated ontological, epistemological, moral, and professional issues. His most significant intellectual achievement was an important biography of the great French social theorist and methodological pioneer Emile Durkheim. In Alpert's effort to craft a viable strategy for the social sciences at the NSF, he also reflected on the nature of the social sciences. Alpert's own views, I argue, underwent significant changes and were more sophisticated than the narrow, scientific policy framework he successfully crafted for the Foundation. Moreover, by the time he left the Foundation, the limits of this success left him frustrated. The roots of his frustrations would give rise to better-known criticisms during the 1960s that identified the NSF as part of the problem confronting the social sciences, not the solution.

**Gabriela Soto Laveaga**, University of California, Santa Barbara

*Populist Science: Politics and National Projects in Mexico, 1970-1976*

Shortly after having founded the National Council on Science and Technology, Mexico's president, Luis Echeverra, traveled to the United States and proclaimed to a journalist that in Mexico, "no political decision is taken without the direct or indirect involvement of scientists." The prevalence of science over politics was a constant theme during Echeverra's six-year term, stressing, for example, that problems such as pollution, environmental degradation, overpopulation and shortage of medications could only be approached from a "scientific basis." But what exactly did science mean to Mexico's decision makers? Although the use of science to mold society was not a new occurrence in Mexico it did however take on a new interpretation during the populist years of Luis Echeverra regime. In this paper I explore how national projects and scientific methods merged to form a new brand of nationalism, what I term Echeverra's populist science.

**Nicholas Spicher**, Johns Hopkins University

*Show and Tell: Teaching Natural Philosophy in the American Colonies*

The 18th century marked a transformation of university natural philosophy courses, both in their content and in their method of delivery. Demonstrations using specialized apparatus became a regular, and even necessary, feature in lectures. While lecture-demonstrations have been recognized for their crucial role in the popularization of science among the 18th-century public, the relationship between these public demonstrations and changes in university curricula has not been fully explored. At the Academy and College of Philadelphia (later the University of Pennsylvania), the pioneering lecturer in natural philosophy was William Smith, the college's first provost. Lecture notes from his courses, both in his own hand and transcribed by his students, reveal that the lecture-demonstration method was integral to his teaching practice. Smith appears to be particularly indebted to his intellectual upbringing in Aberdeen, Scotland, where he would have been exposed to similar methods in university lectures. Smith's approach can be contrasted with a fellow faculty member, John Ewing. An avid amateur astronomer and an active member in the American Philosophical Society, Ewing reflected the mainstream of Newtonian natural philosophy in the content of his lectures. His method, however, differed substantially from Smith's, with little indication from extant lecture notes that Ewing used demonstrations in his courses. By examining Smith, Ewing, and other natural philosophy instructors in the American colonies, I will argue that, even as new standards for the content of courses came to be agreed upon, the method by which they were delivered remained a point of contention.

**Thomas Sturm**, Max Planck Institute for the History of Science

*Bühler's Crisis of Psychology and the Origins of Popper's Critical Rationalism*

How did the debate about a “crisis in psychology”, and the diagnoses and therapies proposed in it, affect a neighboring discipline such as philosophy? An interesting case here is Karl Popper's critical rationalism in the philosophy of science. As is well known, Popper had studied in the psychology department of Vienna University with Karl and Charlotte Bühler. His 1928 dissertation, originally planned as an empirical work concerning memory, was ultimately devoted to methodological problems, as indicated by the title, “Zur Methodenfrage der Denkpsychologie”. It mainly discusses the ontological and methodological views of his two supervisors: Schlick's “Allgemeine Erkenntnislehre” (1918) and Bühler's “Zur Krise der Psychologie” (1927). Popper explicitly states that he aims to defend Bühler's complex methodology against behavioristic and other physicalistic approaches to psychology that had been defended by Schlick and others. The relation between Popper's later philosophical falsificationism and Bühler's “Denkpsychologie” has been found problematic in different ways. On the one hand, it has been claimed that Popper's 1928 dissertation was not yet really a methodological work, or that it did at least not yet address the problem of induction (Hacohen, 2001; Gattei, 2004). On the other hand, it has been argued that Popper later downplayed too much the influence of the “Denkpsychologen” Bühler, Oswald Külpe and Otto Selz upon his philosophy of science (ter Hark 1993, 2003, 2004). I undermine these interpretations in two ways. Firstly, I examine more closely the Kantian background of the psychologists who influenced him, showing thereby that the allegation of a suppressed psychologism in Popper is misguided. Secondly, I highlight that Popper's critical rationalism has nevertheless one of its origins in Bühler's specific proposal for overcoming the crisis in psychology: namely, Popper developed Bühler's theory of language further by arguing that to the three essential functions of language – expression, representation, and appeal – a fourth has to be added: namely, argumentation or criticism, which for Popper became essential to the possibility of objective knowledge.

**Soyoung Suh**, Harvard University

*When Did Chinese Medicine Become Korean? : “Local Botanicals” in the Korean Tradition of Medicine*

It is well known that recorded traditional medicine in Korea began with the sharing of Chinese textual tradition. This beginning consisted not of a single conceptual breakthrough, but rather of a series of deliberate modifications, which modern historians of Korean medicine have often used to demonstrate its distinctiveness. The rise of “Local Botanicals” has been taken up as a gauge for measuring the degree of independence and the extent of indigenization of Korean medicine. This paper aims to rethink this notion that the native attributes of local botanicals portray one of the unique features of Korean medicine. Narratives that place stress on the “nation” raise problems for history of Korean medicine and science. Partly due to the hierarchical notion of “Sinicization,” which reduces the heterogeneity of non-Han culture in East Asia to “Little Chinas,” and partly due to colonial vestiges of Japanese scholarship, Korean historians have attempted to recover Korean tradition from the narratives that present it as a glaring example of Sinicization. Although this serves the contemporary desire to establish a national tradition well, this emphasis on Korean uniqueness hardly gains audience outside Korea. While elaborating the way in which local botanicals were defined and textualized in Korea overtime, I argue that local botanicals should be viewed not as an icon of “Koreanness” in medicine, but as a historically employed tool for consumption and accommodation, which was indispensable to the people who were situated at the cultural and political margins of first Sino-centric, then Japan-West centered world orders.

**David Teira**, Universidad Nacional de Educacion a Distancia (Madrid, Spain)

*The Theology of Large Numbers: A Conjecture*

The aim of this paper is to discuss the implicit theology underlying a central assumption of the fourth part of the *Ars Conjectandi*: the affirmation of divine omniscience and omnipotence. From the standpoint of medieval theology, This assumption involved two different problems: whether we were really free to choose and what moral significance a probabilistic election may had. We will discuss its intellectual roots, exploring the correspondence with Leibniz in the light of the controversy between Dominicans and Jesuits as to the way God concurs in our actions. By way of conclusion, we will briefly discuss the moral significance that might be granted to the *Ars Conjectandi* from a Calvinist perspective, and in what precise sense probability was rendered a secular tool for decision making

**Mary Terrall**, UCLA

*Frogs on the Mantelpiece: Glimpses into the Observing Life*

This paper explores the mundane procedures and strategies of observation, as practiced in a French country house near Paris in the 1730s. Observers self-consciously cultivated certain habits of mind, but they also made observation a way of life, incorporating their activities into the routines of household and laboratory. Based primarily on unpublished observational notes and drawings, I reconstruct observations of mating frogs that engaged the attention of the French naturalist Réaumur and several associates for a few weeks in the springtime for several seasons. A close reading of the manuscripts yields some clues about experiments on fertilization, but also about the mode of working of Réaumur and his collaborators (Abbé Nollet and du Moustier). The very inconclusiveness of his observations reveals the dailiness of frustration that characterized much of the work of natural history. Réaumur never transformed his notes into a consistent narrative of discovery, in part because he never got conclusive answers to his questions. The jumble of queries, experiments, details of the frogs' behavior and possible explanations betrays the confusion and the open-endedness of the inquiry. The notes also show the observer interacting with his subjects, while framing questions to guide further experiments. The frog observations were part of a small-scale and decidedly low-tech operation, suited to the country-house setting where they took place. The paper uses this minor byway in 18th-century natural history to show how observation was integrated into the life of the household.

**Daniel Thurs**, New York University

*Martian Madness: Orson Welles' War of the Worlds and the Construction of Mass Panic as a Response to Advances in Science and Technology, 1938-2003*

In 1938, tens of thousands, perhaps even millions of people from across the United States panicked at the “news” that Martians had invaded rural New Jersey – or so the story goes. Accounts of the mass hysteria that supposedly followed Orson Welles’ famous radio adaptation of *The War of the Worlds* have ever since provided amusing tales of public credulity. But they also reveal what has become a core belief about the public and its relationship with cutting edge science and technology. After World War II especially images of screaming crowds lurked behind the assumptions of the modern security state and the public relations of aspiring experts of all kinds. The specter of mass hysteria also provided one means of regaining symbolic control over a science that was increasingly commercialized, and thus dependent on public tastes. The expectation of public panic has had a hand in shaping discussion of such diverse phenomena as widespread reaction to atomic weapons, response to the detection of extraterrestrial intelligence, and reception of genetically modified foods. Meanwhile, reiteration of the presumed events of 1938 often appeared as “evidence” of the public’s unreliability in the face of advanced science and technology (e.g., the radio in 1938). In this paper, I will examine the construction of reaction to Welles’ broadcast by social scientists and media analysts, while motioning toward the more general construction of a particular view of the public during the twentieth century as unreliable, as well as this views’ effects on political, economic, and technical decision-making.

**Margareta Tillberg**, Max Planck Institute for the History of Science, Berlin

*Design of Control Rooms: Russia under Brezhnev*

This paper will discuss the interior design of control rooms as embodied epistemology in practice. At the All- Union Scientific Institute for Technical Esthetics, abbreviated VNIITE, a research institute for design founded in 1962, joint efforts from various disciplines were put into effect. Allowing occasional free zones for research, laboratories for observations and experiments were created by ergonomicians and psycho-technicians in co- operation with artists, designers and musicians. The “brain” of a larger system, the control unit can be seen as an interface between the responsible user and its functional surrounding put into action. The visual and organizational designs of these spaces demand complex insights in the various perceptual levels of the human factor (visual, auditory, etc), of the interactive processes as well as of the physical location. Ergonomics, the study of human capabilities in relationship to their work demands, and its cognitive aspect known as engineering psychology, investigated mental processes including visual and motor control as well as memory storage to produce the most effective working space. The presentation will offer some concrete examples of projects for control room interior design.

**Honghong Tinn**, Cornell University

*Science, Technical Aid, and Tinkering with Mainframe Computing in Cold War Taiwan, 1955-1965*

This paper examines how the ideas and practices of digital computing emerged and became entrenched in postwar Taiwan. The science of computing and the proliferation of computers in the United States after World War II were inseparably bound up with the Cold War discourses and the military-related networks. Without participating in early US or British computer research, Taiwan gained access to mainframe computers through opportunities created by the international politics in the 1950s and 1960s. During this period, Taiwanese economists, technocrats, scientists, engineers, technicians, and college students used available resources from a technical aid program to facilitate the academic learning of mainframe computing. This paper proposes to explore how computer science in Taiwan was shaped by the role of Taiwan in Cold War containment politics, the development discourse, and Taiwanese technocrats’ ideas of nation-building. Specifically, this paper examines a “technical co-operation program,” in which National Chiao-Tung University in Taiwan used a United Nations’ special fund in 1962 to lease an IBM 650, Taiwan’s first mainframe computer in academia, for its graduate program in electronics. On top of direct financial assistance, the United Nations recruited five US scholars to train Taiwanese scientists, engineers, and technicians. This paper explores how Taiwanese and UN agencies made computing knowledge and instruments available transnationally, with a focus on Taiwanese computer users’ learned efforts to use and maintain the new machines and related knowledge.

**John Tresch**, University of Pennsylvania

*Fantastic Instruments: Berlioz, Meyerbeer, and the Foucault Connection.*

Mid-19th century instruments were not just ultra-rational; they were also uncanny, as illustrated by spectacular technology and musical performance in Paris around 1848. Physicist Leon Foucault was both science reporter and inventive experimentalist, using the daguerreotype in microbiology and calculating the speed of light. Foucault was also in close contact with innovators of the Parisian opera Hector Berlioz and Giacomo Meyerbeer. Berlioz produced new soundscapes using new and strange instruments in his *Symphonic Fantastique*; he also experimented with electricity and telegraphy as means of synchronizing instruments. Meyerbeer-- whose brother, Wilhelm Beer, was an astronomer in Berlin-- also employed new sounds and stage machinery (including roller-skating nuns) in his phantasmagoric *Robert le Diable*; he collaborated with Foucault to bring electric illumination to his 1849 allegory of revolution, *Le Prophete*. Considering innovations in musical performance of this time alongside Foucault’s public science-- notably his colossal, state-sanctioned pendulum “experiment” in 1851-- suggests a broad concern, equally romantic and mechanizing, with the relation between the senses, technology, and the public. These artificial paradises were “experiences” for both eye and ear; in a time of revolution and reaction, they could reveal the truth of nature, intimate the supernatural, and both reinforce and undermine the state’s ideology of control.

**Matt Tribbe**, University of Texas at Austin

*"A Far-Out Device": Confronting the Thrilling, People-Killing Neutron Bomb in Carter-Era America*

In the summer of 1977, Americans learned that their government was on the verge of producing enhanced radiation weapons, or "neutron bombs," as the public came to know them. While the weapon was in reality a minor modification of the thermonuclear warheads the United States had possessed since the 1950s, its ability to kill people with neutron radiation while doing comparatively little damage to surrounding structures ensured that it would be widely considered a revolutionary new nuclear weapon. This talk will examine how cultural fears of radiation and of science running roughshod over morality impacted the political debate over the neutron bomb. Unprepared for the public uproar that the production announcement created, the Carter administration and Department of Defense initially failed to adequately defend the necessity of what seemed to many a particularly bizarre and heinous new weapon. As a result, the neutron bomb became as much a cultural as a political controversy, with musicians, novelists, filmmakers, columnists, television personalities, and other culture-shapers offering the public fantastic visions of what a neutron bomb was, and what it was capable of doing. Thanks to this cultural controversy, Americans became aware that their government was considering the possibility of fighting and winning small-scale, "limited" nuclear conflicts with the Soviets without necessarily escalating to large-scale nuclear exchanges, sparking the first substantial public debate over the value of tactical nuclear weapons like the neutron bomb and their effect on the theories of deterrence and "limited nuclear war."

**Elly Truitt**, Bryn Mawr College

*Necromancy, Celestial Divination, and the Introduction of Arabic Science into England, c. 1050-1125*

This paper examines how the introduction of Arabic science, specifically astronomy and astrology, into England in the late eleventh and early twelfth century led to a shift in the understanding of processes of divination. By 1125, when William of Malmesbury completed his *Gesta Regum Anglorum*, these processes included, along with a demonic cause, causality predicated on the powers and movements of celestial bodies. I focus on William's account in the *Gesta Regum Anglorum* of how Pope Sylvester II (Gerbert of Aurillac) created a prophetic head by using astronomy; this is a significant change from earlier versions of the same story, in which authors attributed the talking head to Gerbert's adeptness in summoning demons. I will show that it was the introduction of Arabic astrology and astronomy into England that accounted specifically for William's updated version by examining the network of adherents to this new knowledge in England in the early twelfth century.

**Roger Turner**, University of Pennsylvania

*Comics in the TV Weather Report*

The weather report became a staple of local television in the United States during the 1950s. While viewers clearly desired weather information, it was not obvious how meteorology should be presented. Public meteorology's existing visual culture, built upon detailed synoptic maps printed in newspapers or mailed to subscribers, did not translate onto television's low-resolution screen. Stations and broadcasters experimented with a variety of formats, including mechanical dials, puppets, and ukulele-playing beauty queens. By the late 1950s, this experimentation converged on a common form: a genial man narrating a simplified weather map, often illuminated by cartoonish illustrations and hand-drawn while on the air. This style drew on perhaps the most broadly shared element of American visual culture, comic art. Many broadcast meteorologists enlivened their forecasts with caricatures, recurring characters, stylized text, and other idioms from the language of comic strips. This poster depicts the evolution of popular meteorology's new visual culture. First, newspaper comic strips and magazine advertisements from the 1890s-1930s illustrate the development of comic art's shared language. Second, images from World War II training manuals show how comic art developed into a medium for communicating technical information to mass audiences, like teaching meteorology to student pilots. Finally, photographs from weathercasters' memoirs and cartoon images from promotional ephemera document how comic art mediated the presentation of weather information on television. Thus, the American public's most preferred reading material, comic strips, structured its most common scientific experience, the TV weather report.

**Matthew Underwood**, Harvard University

*Government by Questionnaire: Epistemic Technique as Political Technology in the Early Modern English Atlantic World*

In 1667, Thomas Sprat famously cited the growth of two institutional "twin sisters" – the Royal Society and the Royal Africa Company – as exemplary of the English nobility's patronage of institutions dedicated to increasing "traffic," and thus to building a trading empire global in scope. The substance of Sprat's remark, however, has since typically dismissed as more ambitious than accurate: neither historians of science nor political historians regard the Royal Society as an institution crucially involved with the construction of empire. This paper, however, will argue Sprat was right. Specifically, it will argue that an epistemic technique developed by the Society – the composition of natural histories and histories of trade by the circulation of questionnaires – was later adopted as an instrument of governance by institutions such as the Board of Trade, which were charged with regulating the commercial traffic that sustained Britain's Atlantic empire. Departing from previous histories of science and empire in the period, it will argue that the Society did not simply gather and analyze the various curiosities of empire that, largely by chance, washed ashore in London; rather, it played a crucial role in developing and managing the empire-wide networks along which both science and commerce were conducted. While other scholars have shown how the knowledge economy reflected dominant mechanisms of sociability in early modern England, this paper will examine an opposite trajectory: namely, how new ways of managing knowledge production developed by the Society became the model for how to govern a trading empire spanning the globe.

**Simona Valeriani**, London School of Economics

*Scientific Facts and Building Artefacts*

Scientific facts are very often expressed or associated with statements and a verbalized description. But some facts - and particularly facts about technology - are often better transmitted and recorded in material objects. The history of architecture is in fact rich in studies concerned with the diffusion of design principles and their interplay with art history, social history and the history of ideas. But what about the know-how needed in order to actually build a given design? By concentrating on the transmission of technical knowledge in the field of architecture, the paper addresses the problem - delineated in recent times in the history of science community - of the interaction and mutual influences between bodies of practical and theoretical knowledge in the early modern period. At the turn to the 17th century, new theoretical writings started to appear that tried - with a novel approach - to make sense in a scientific-mechanical way of (established) structural solutions to construction problems. The analysis both of these written sources and of the built heritage from the same period, results in an intriguing delineation of the way in which propositional scientific knowledge of mechanics and tacit craft knowledge of building structures interlace.

**Maarten Van Dyck**, Ghent University

*Mechanical foundations for collision*

The attempts of people like Huygens and Wallis to give a mathematical treatment of the phenomenon of collision are almost invariably interpreted as somehow belonging to the Beekman–Descartes project of constructing a corpuscularian worldview. Whereas this might make some sense for Huygens (but much less for Wallis), I want to explore a different way of interpreting the nature of their attempts – taking my clue from the fact that Huygens, in what seems to be a draft for an introduction to a treatise on collision (OH 16, 112-113), squarely puts his treatment in the line of Galileo’s unfulfilled promise in the *Discorsi* to add an explanation of the mechanical multiplication of force effected by the percussion of bodies; and from the fact that Wallis published a full-scale exposition of his treatment of collision in his book on *Mechanics*, which integrated it within a rather traditional exposition of the simple machines and the Galilean science of accelerated motion. This kind of attempt to integrate percussion effects within mechanics goes already back to the (pseudo-)Aristotelian *Mechanical problems*, and is also taken up (albeit cursorily) by both Guidobaldo del Monte and Galileo himself in their treatises on the simple machines. Starting from this observation, I will show in what way Huygens’s and Wallis’s treatments nevertheless go beyond Galileo’s failed attempt (of which we have manuscript evidence); but also how this explicitly mechanical background allows them to take a different perspective on Descartes’s rather awkward treatment of the phenomenon of collision.

**Brigitte Van Tiggelen**, Brigitte Van Tiggelen

*Women of science and wife of a scientist : Ida Noddack-Tacke (1896-1978)*

Ida Tacke studied chemical engineering at the Technische Hochschule in Berlin, and was employed as a chemist at AEG. She resigned to work for free at Siemens-Halske and at the Physikalisch-Technische Reichsanstalt (PTR) in Berlin, searching for missing elements 43 and 75. The head of the chemistry department at the PTR, Walter Noddack, came to be not only her collaborator, but also her husband from 1926 on. As a married woman, Ida Noddack was no longer entitled to a career of her own. However, Ida was able to pursue unpaid scientific work, following her husband wherever he was appointed. Through her career she published about 70 papers, most of them in German and many in collaboration with Walter. Their most famous joint work dealt with the search for undiscovered elements. Eventually the discovery of Rhenium (75) was acknowledged. This achievement led to three joint Nobel nominations, besides another two for him. Ida was the third woman to be nominated for a Nobel prize, in good company with Marie Curie and Lise Meitner. Ida Noddack is also known for proposing nuclear fission in 1934. As a married woman she had to withdraw from her career, but at the same time, being the wife of a scientist, she enjoyed the privilege of having access to her husband’s research facilities and being connected to a group of fellow scientists. Ida and Walther Noddack add to the many “creative couples” in science such as Marie and Pierre Curie and many less famous couples.

**Theresa Ventura**, Columbia University

*From Tropical Agriculture to Ethnobotany: Trajectories of American Agricultural Science in the Philippines, 1898-1946*

This paper explores the intellectual trajectories of American agricultural science in the Philippines. Tropical agriculture, much like medicine, was an imperial science designed to make colonial environments both intelligible and controllable. Agricultural experiment stations in concert with advances in plant genetics and soil science segregated scientists from the social context of Philippine agricultural production and, in theory, allowed them to harness the “latent energies” of the soil; energies they assumed had rendered Filipinos inert. However, situated between civilian administrators, Philippine landowners, and Philippine laborers, agricultural scientists on experiment stations and model farms found their control over the farm laboratory was tangential at best. Torn between whether or not the science performed at agricultural experiment stations should benefit U.S. importers, Philippine landowners, or farm laborers, agricultural scientists diverged over the meaning and direction of colonial science. A few scientists, such as botanists Elmer D. Merrill and Harley Harris Bartlett, opted out of such controversies, instead focusing on the ways in which Filipinos interacted with the natural world. These self-described “ethnobotanists,” drawing upon the disciplinary tools of anthropology, became some of the fiercest advocates for natural resource conservation and for the preservation of local knowledge.

**Koen Vermeir**, University of Leuven/Paris 1- Sorbonne

*Circulating knowledge or superstition?*

In this paper, I will study a particular case of circulation of wonders in the Low Countries. Wonders circulated widely because of their news value and the entertainment they provided. They had also a distinct epistemic import, for natural philosophy as well as for theology. The question whether particular wonders were caused by nature, demons or God was always occasion for controversy. In 1692, a French peasant was able to follow three fugitive murderers with a divining rod. A divining rod was widely used to find water and metals, but this was the first time it was used to trace criminals. In this paper, I will detail the particularities of the Dutch reception and circulation of these curious events. Natural philosophers, publishers and theologians became involved, among which Balthazar Bekker, Antoni van Leeuwenhoek, Pieter Rabus and Pierre Bayle played a prominent role. I will show how knowledge claims, divining rods and human bodies were circulated in the Low Countries, especially by personal and publishing networks, in order to demonstrate the new and wondrous capacities of hazel rods and human bodies. The curious aspect of this controversy, however, was that only some people possessed this skill, and this made many people suspicious and critical. I will analyse the material circulation of objects and people, with a special focus on the epistemic aspects of the circulation of knowledge and superstition. Even if objects and claims circulated materially, what was the meaning and value attributed to them in the Low Countries? How did they function in the debate about superstition and epistemic error? Why were they accepted or rejected by the historical actors?

**Jeremy Vetter**, Dickinson College

*Rocky Mountain High Science: Teaching, Research, and Nature at Field Stations*

By the early twentieth century, the field station was becoming a familiar institutional form for scientific research that combined proximity to the field with the semi-permanence of built structures for laboratories. The earliest biological field stations, such as Naples or Woods Hole, often were located at the seashore, and later stations emerged along interior lakes and rivers. Such locations at the boundary between land and water extended intensive research settings from the cities and towns of academic institutions into the horizontal vastness of the field. Yet field scientists soon started to locate their stations upwards, leveraging the verticality of the mountain slope. Scientific explorers had long identified mountains as places where enormous horizontal, usually longitudinal, sequences of environments were compressed into relatively tight vertical zonation. This paper examines the proliferation of field stations in the Rocky Mountains of the American West in the early twentieth century. Proponents of these field stations touted their epistemic virtues as places where a great diversity of environmental zones—stretching from alpine summits, through forested slopes and foothills, to the wide-open plains—could be studied in one location, thereby transcending their local particularity for acquiring knowledge of global environments. Concentrating especially on the Mountain Laboratory of the University of Colorado, but with ample comparisons to other Rocky Mountain field stations, this paper assesses the extent to which mountain field stations succeeded in integrating teaching, research, and the great diversity of nature on the vertical mountain slope, both in station leaders' visions and in practice.

**Marga Vicedo**, University of Toronto,

*The Secret Life of Children: Searching for Children's Natural Emotional Needs from London to Baltimore, via Uganda.*

In this paper, I examine the rise of scientific research on children's inner needs after WWII. I first look at John Bowlby's work in London hospitals. I then turn to Mary Ainsworth's studies of mother-child interactions in Uganda and Baltimore as well as her experimental work on the "Strange Situation." On the basis of these diverse studies, Bowlby and Ainsworth argued that children need a secure base for their healthy development. They also developed the Ethological theory of Attachment behavior, which postulates that children have an instinctual need for mother love. I explore how Bowlby and Ainsworth contributed to the project of constructing children's inner emotional needs as universal and uniform biological requirements. I argue that the history of attachment theory needs to be understood in relation to Cold War concerns about the importance of emotions in personality formation. This history of scientific research on children's psychological development helps us to understand the changing epistemological value given to observational, experimental, and evolutionary explanations of behavior. More generally, this key episode illuminates the growing role of science in children's lives and the significance of children for science.

**Kathryn Vignone**, Cornell University

*Nanoimage Work at the Exploratorium's Viz Lab*

In their partnership with the National Science Foundation's (NSF) multi-institutional Nanoscale Informal Science and Education (NISE) Network, the members of the Exploratorium's Visualization Laboratory (Viz Lab) have been investigating and implementing effective ways to present nanoscale images to the general public. In view of the special vision of the Exploratorium, the NSF made the science museum's researchers responsible for developing visual materials for the NISE network. The NSF assigned two other lead institutions distinctly different roles: the Science Museum of Minnesota has been responsible for developing exhibit materials that other museums rent, and the Museum of Science in Boston is responsible for organizing public discussion forums about nanotech. This poster examines the short history of nanoimages and image-work at the Viz Lab. Data and images are highly mediated in the visualization of nanotechnology, even at the Exploratorium, which explicitly attempts to reduce that mediation to a minimum. The nanoimages in this poster each reveal various networks of creation, mediation, and public communication. This poster, while admittedly allowing many of those histories to remain invisible (such as details of how scientists produced the image-data prior to its arrival at the Viz Lab), will focus on particular choices the Viz Lab researchers have made.

**Marco Viniegra**, Harvard University

*The moral dimension of Galen's ideal doctor.*

If the best doctor is not only a philosopher, but is also the man most capable both in the art of logic and in the realm of ethics – including the moral and behavioral dimension, then is the best philosopher by necessity a doctor? By studying Galen's observations and principles concerning the ethical aspect of the practice of medicine present in Galen's *On my own books*, *The order of my own books*, *That the best doctor is also a philosopher*, *The errors and passions of the soul*, *The method of healing*, *The ethics*, and *book nice of On the theories of Plato and Hippocrates*, which include his ideas on Philosophy as well as his propositions on logic, the scientific method, and mathematics, I plan to explore what seems to be a constant set of premises behind Galen's works, premises that clearly pointed to the notion that the best kind of man – that is the philosopher – was, by necessity a doctor. Such a notion both recovered some of the most important ideas of the ancient world inherited by Galen, and transformed them into an ethical dimension proper of Galenism and its Late Antiquity flavor. This recover and transformation allows us to see more clearly the direction of the ethical and medical thought of Galen's time.

**Brant Vogel**, Columbia University

*Gentle-women at London: Gender and the Rise of the Weather Instrument*

In the first print advertisement for the barometer, George Sinclair, professor at Edinburgh, besides trumpeting the utility of an instrument which could predict the weather, appealed to the class anxiety of his provincial patrons. His 1683 advertisement noted that the "gentle-women at London, do Apparel themselves in the Morning, by the Weather-glass." What Scotsman of distinction would deny his wife something common to fashionable ladies of London? This advertising pitch would become a common feature in the instrument trade. The image of the lady and the weather-glass can also be found in the popular literature of meteorology. John Porter (1723), describing domestic weather, said, "even those of the Fair Sex, are unwilling to stir abroad unless the Weather be like themselves, and they like the Weather." This domestic function also informed the design of weather instruments. Did women actually embrace these instruments? A survey of women's writings shows that they paid little attention to them other than disdain. So what does this image of the lady and the weather-glass say about the men who bought instruments, and about the popular adoption of weather instruments in general? This paper argues that the domestic weather instrument which decorated the smart houses of London and the country manor houses of 17th and 18th Century England, like landscape painting, formed representations of the property of English gentlemen, and the identity they derived from it. Women, who participated less in Locke's pursuit of "life, liberty, and property," remained disinterested.

**Sarah Vogel**, Columbia University

*“Known Knowns,” “Known Unknowns,” and “Unknown Unknowns”: Communicating the Risks of Bisphenol A in the Plastics Age, Late 1970s to the Present*

Over the course of the twentieth century, the lead, tobacco and chemical industries drew upon scientific uncertainty—what isn't known—to effectively stall and thwart regulatory action and defend the proliferation of its products as safe. The logic followed that if regulatory action was based on what is known, it served industry's economic interest to support scientific research that upheld the safety of its products while emphasizing scientific uncertainty when evidence of harm might emerge. Strategically interpreting scientific evidence as certain or uncertain frames the central debate about chemical risk and safety. This paper traces the history of the communication of the risk and safety of bisphenol A, a chemical used in the production of plastics, by industry representatives, regulators, research scientists and environmental advocates from the 1970s to the present. Bisphenol A came under considerable scientific scrutiny in the 1970s when the federal government expanded its research on environmental health. What was known about chemicals expanded in unexpected ways that challenged the presumed safety of bisphenol A. Industry representatives responded by drawing on what was known—scientific certainty—to support the safety of bisphenol A while minimizing any evidence of harm by highlighting the scientific uncertainty. Conversely, environmental organizations and a growing number of scientists leaned on what was known to highlight the serious risks of this chemical. As a result, scientific certainty and uncertainty represented shifting epistemological frameworks that reflect competing political ideologies about the relationship between the administrative state and private industry in the U.S.

**Mark Waddell**, Michigan State University

*Kircher's singing Cats, or, Syncretism as Catholicism*

Athanasius Kircher (1602-1680) and his disciple Gaspar Schott (1608-1666) were viewed in their own time much as they are today: as overly-credulous encyclopedists with a penchant for the bizarre and outlandish. Their massive volumes were filled with a dizzying array of exotic naturalia and inventive technologies, the two things sometimes indistinguishable from one another. From Kircher's remarkable feline harpsichord (which inspired Schott's donkey chorus) and his infamous sunflower clock to the organic pyrotechnics of bioluminescent plankton, the lines between art and nature were continually breached in innovative, often startling ways. Contemporary audiences were beguiled and confused by turns, much as we are today. But this exuberant syncretism—the merging of two such disparate realms—was useful in shaping a powerful notion of universality. This was truly a catholic view of the world, in every sense of the word. Accordingly, this paper will explore the syncretism fostered by Kircher and Schott and suggest that it can be linked with elements of seventeenth-century Jesuit culture, particularly the apostolic goals of the Society of Jesus and the inculcation of an imaginative probabilism that sought to connect the mind of the individual with the entirety of God's creation.

**Maxim Waldstein**, Leiden University

*Toward the Humanistic Calculus: The Formalist Renaissance in Soviet Linguistics, 1950-1963*

This paper examines the history of the structuralist/"neo-formalist" movement in Soviet linguistics, literary studies and communication sciences in the 1950s-early 1960s. Based on primarily Moscow archives and a series of personal interviews, I trace the intellectual and institutional trajectories of specific individuals and groups involved in this movement. The paper demonstrates that, although aimed at challenging the Stalinist state-science "contract," this movement was (ironically enough!) made possible by Stalin's intervention in linguistic debates in his famous 1950 Pravda article. Stalin's surprising attack on the established "Marxist linguistics" inadvertently created an opportunity for non-Marxist linguists to claim and (re)establish their legitimacy within their discipline and a wider field of human studies. A whole cohort of young scholars made active use of these opportunities. In particular, they attempted to institutionalize the new disciplines of structural linguistics and semiotics as models of legitimate humanistic discourse. In this, Soviet structuralists relied strongly on their influential allies among natural scientists and the military. Furthermore, by focusing on the history of specific research projects, e.g. machine translation and structuralist poetics, I demonstrate the significance of the Cold War competition between the Great Powers and the newly opened opportunities for international scientific exchange for framing the struggles for intellectual and institutional authority in Soviet human sciences. My story ends with an account of the apparent official crackdown on linguistic and literary structuralism in 1963.

**Kevin Walsh**, University of California, San Diego

*Bringing the Future Closer: The Emergence of the U.S. Academic Supercomputer Centers 1980-1990*

The first Cray 1 supercomputer was installed in the Los Alamos National Laboratory in 1976. The vector architecture of the machine produced processing speeds 1000 faster than other high performance computers of the day. Access to supercomputers at the time was very restricted, due to their expense, the low number of machines in operation, and to the security policies of their host locations: the national weapons labs. Thus, such computing power was off limits to almost all academic scientists in the U.S. until the mid-1980s. The first Cray 1 in continental Europe was installed in the Garching Computer Center in the Max Planck Institute for Plasma Physics (IPP) in 1979. The IPP Cray was available for open research, and was used by a large number of U.S. academics. It is a strange irony that U.S. academics had to take up temporary residence in a foreign country in order to use a computer made in America. Although such limited access to supercomputers was embarrassing to the U.S., the technical shot across the bow of the U.S. research ship of state came from Japan. In 1983, Japan announced the 5th Generation Computer Systems Project, a large-scale government/industry effort charged with creating a massively parallel computing platform. In response to these challenges to America's dominance in science and technology, the National Science Foundation created four supercomputer centers for the U.S. academic research community in 1985. This paper will outline and analyze the scientific futures used to justify the creation of the Centers.

**Scott Walter**, University of Nancy

*Cambridge dynamics and German relativity, 1909-1915*

In the early years of relativity theory, Cambridge physicists, steeped in the traditions of British elasticity theory and electromagnetism, encountered difficulty in understanding the new physics of uniformly-rotating frames. Their struggles have been taken to be emblematic of technological determinism arising from insular, hidebound theoretical traditions. However, the absence of a canonical approach to uniform rotation in relativity theory circa 1910-1912, or even a consensus among leading theorists, excludes such an interpretation in this case. By 1915, the old theoretical approaches were displaced by new formal techniques, including Minkowski maps and the Sommerfeld-Laue spacetime calculus, which transformed and unified the practice of relativity in British and German physics.

**Benjamin Wang**, Cornell University

*Literally Above Politics?: NASA, the Deep Space Network, the Congressional Black Caucus, and Apartheid South Africa*

In 1974, NASA took its Deep Space Network (DSN) station in apartheid South Africa offline. The DSN was one of NASA's many networks used for monitoring satellites and spacecraft, for which its prime location was downrange from Cape Canaveral. Yet, after less than 15 years of operation, NASA closed the station, claiming that more responsibility could be placed on other stations and the end of the manned program eliminated the need for the South African station. The DSN station was the subject of congressional hearings on American involvement with South Africa and NASA appropriations, however no legislative action was ever passed. Given how at least three groups – NASA managers both at headquarters and at the Jet Propulsion Laboratory (JPL), Congressmen Charles Diggs and Charles Rangel, who were the first members of the Congressional Black Caucus, and government officials in South Africa's Council for Scientific and Industrial Research (CSIR) – as well as others all wanted to shape the network, my goal will be to identify how those actors interpreted the decisions about the network with regard to the DSN station in South Africa. Previously unpublished materials from the archives of NASA headquarters, JPL, CSIR, and Congressman Diggs, provide an alternative explanation of the decision to eliminate the DSN station in South Africa that takes into account the different interpretations of the science and politics of the South African station by NASA managers, congressional leaders, and South African officials.

**Zuoyue Wang**, Harvey Mudd College

*A Model of Modernity? Chinese American Scientists in China since 1971*

The US-China reopening in the early 1970s marked a turning point in the history of Chinese American scientists who did more than any other group in the launching and the growth of scientific and educational ties between the two countries. These experiences transformed them from a secluded elite group in a marginalized “model minority” in the US into agents of transnational technoscience, with cultural and even political import especially in China. This paper examines how Chinese American scientists demonstrated and used their cultural nationalism to promote an influential version of modernity in China against a backdrop of Chinese economic growth and social change in the late 20th and early 21st centuries.

**Spencer Weart**, American Institute of Physics

*“Educational Toys:” The Evolution and Persistence of Simple Models of Climate Change*

Climate change is especially difficult to understand because even gross effects cannot be estimated except with highly complex computer models. Until the mid 20th century, scientists attempted to explain climate change in readily graspable terms, for example qualitative explanations for the ice ages. More formal models used basic equations to calculate seemingly simple features like “greenhouse effect” warming, but the models were known to be fundamentally flawed. In the 1950s, new qualitative “hand-waving” models pointed to a possibility of abrupt and catastrophic climate change; experiments with actual physical models using fluids helped make that plausible. Some one-dimensional computer models also showed abrupt changes, while others attempted to estimate greenhouse warming. These still failed to include crucial phenomena. In the 1970s, elaborate three-dimensional computer models finally confirmed that significant greenhouse warming was likely and that abrupt shifts were possible. The warming and shifts were emergent phenomena, however; not even the modelers themselves understood them in the manner one grasps a traditional physics problem such as planetary motion. Meanwhile hand-waving explanations retained a role as “educational toys” among scientists for exploring questions beyond the power of any computer representation, and also figured prominently in public debates. For example, elementary (and flawed) arguments about possible changes in ocean circulation had a significant impact on both scientific and public understanding into the 21st century. Explaining why, and how far, we must rely on complex computer models is a great challenge in science-and-society relations.

**Nadine Weidman**, Harvard University

*Gender and Aggression in 1960s Popular Ethology*

In the late 1960s, a spate of popular science books made the claim that human beings possess an instinct for aggression. This paper will examine four of these books: *On Aggression*, by the ethologist Konrad Lorenz, *The Territorial Imperative*, by the playwright Robert Ardrey, *The Naked Ape*, by the ethologist Desmond Morris, and *Human Aggression*, by the psychiatrist Anthony Storr. Their authors were a diverse group who crossed disciplinary and professional borderlines to learn from and influence each other. In their books, these authors conceived of aggressiveness as an instinct that connected human beings to the animal world, as well as worked as the motor of evolution, driving our proto-human ancestors apart from their ape-like forbears and allowing them to reach truly human status. For each of these authors, aggression had a creative aspect; far from being only a negative emotion, it was a productive force that required means of safe expression. The aggression instinct was also defined in gendered terms: the aggression that defended a territory, created social order, and brought civilization to new levels was a solely masculine type. Female aggression existed, but it sprang from entirely different motivations and had entirely different results. I will show that despite their varied backgrounds, Lorenz, Ardrey, Storr, and Morris created a remarkably consistent picture of the aggression instinct, as powerfully creative and indubitably masculine, for the American reading public in the 1960s.

**Staffan Wennerholm**, Uppsala University

*Invisible work in the scientific family: The case of early twentieth century Swedish geology*

Collaborations within scientific families have sparked some interest among feminist historians of science. Drawing on the example of the Swedes Gerhard De Geer and Ebba Hult De Geer, this paper will connect that discussion with discourses in feminist history and sociology of science on power and “invisible” scientific work. After their marriage in 1908, Ebba Hult worked as Gerhard De Geers assistant for thirty years. He was an influential and esteemed geologist while she only received some official recognition of her work towards the end of their collaboration. This paper will argue that the family is an important instance in understanding how power and visibility were distributed in early twentieth century science. The partnership of the De Geer family generated authority and official recognition for Gerhard but not for Ebba. At the same time it was done in accordance with contemporary norms of family life as well as of the scientific community. Consequently, the family collaboration is a pertinent place to study historical norms and structures producing power relations and invisible scientific work. Moreover, this paper will argue that family relations were integrated in other informal connections, i.e. friendship and social network ties, and the boundaries between them were opaque. Furthermore, all of these overlapping networks entailed power relations and invisibility. Hence, through investigating family collaborations, and through using Ebba Hult De Geer as an example of a marginal, unofficial and invisible scientific worker, this paper will enhance the understanding of power structures in informal scientific associations more generally.

**Jacqueline Wernimont**, Brown University

*Modes of Meaning in Seventeenth-Century Mathematics*

During the sixteenth and seventeenth centuries vibrant new possibilities were envisioned for both poetic and mathematical semiotics in Britain. Practitioners of each argued on behalf of a notational system carrying significant ethical and social power in addition to its explanatory capabilities. Using the intensional theories of poesis and mathematics offered by Sir Philip Sidney and John Dee respectively as a background, this paper will consider seventeenth-century modes of mathematical expression. Like the writing of Sidney and Dee, the intensional mathematics of René Descartes and others were semiotic systems for expressing and exploring the possible. These mathematic semiotics of the possible functioned very differently than praxis-oriented extensional mathematical modes. This paper will explore the nature of intensional mathematic writing and suggest how its social, epistemological, and political functions in the seventeenth century impacted the assessment of seventeenth-century literary writing as a knowledge technology.

**Simon Werrett**, University of Washington, Seattle

*Science Goes Pyrotechnic: Fireworks as a Resource for Electrical Performance in the Eighteenth Century.*

This paper examines the eighteenth-century culture of pyrotechnic spectacles as a context for the performance of electricity. Historians have long noted the use of “fiery” language to describe electricity in the eighteenth century, as an “electric fire” giving off “sparks”, but little consideration has been given to precisely which kinds of fire philosophers had in mind. In this paper the art of making artificial fireworks is considered as a resource in early electrical science. Using a variety of artisanal manuals, handbills, philosophical papers and contemporary images, the paper explores techniques of language and performance surrounding fireworks displays in the eighteenth century, and identifies them as important resources for electrical experimenters. Fireworks not only provided an existing form of experience through which to articulate in words the novel phenomena, sights, smells, and sounds of electric “fire”, but also a repertoire of performance techniques with which electric fire could be made appealing to new audiences of polite spectators. Electric fire was unique, but, the paper suggests, the fashion for electricity and for natural philosophy which it brought about was in part a result of adopting the style of fireworks as a means to appeal to audiences.

**Kelley Wilder**, De Montfort University

*Observation and the Photographic Method in the Laboratory of the Becquerels*

Alexander Edmond Becquerel began experimenting with photogenic drawing paper and daguerreotype plates as soon as they were available in 1839. Not only did he become a force in the photographic organization of France, inventing a method of daguerreotyping that still carries his name and becoming a founding member of the Société Française de Photographie, but he established a tradition for using photography in the investigation of radiation of all sorts. By the time Antoine Henri Becquerel, his son, discovered that the radiation emitted from Uranium salts was not the same as that emitted from a cathode ray tube, the Becquerel lab had become a center for the observation of radiation via a self-styled “photographic method.” Henri Becquerel worked with many scientists in Paris, among them Deslandres, Villard and the Curies to make photographically visible the discoveries and theories sprouting up in the field of radiation studies. The resultant images were disseminated in journals (*Le Radium*), and by exhibition at the Royal Photographic Society, London. Not all photographic methods are the same, and all of them need to be established, tested, promulgated and, in the end, accepted by the scientific establishment. Previous work written about photographic methods has focused on Marey’s graphic method, ignoring the great influence of the Becquerels. This paper investigates the role of the Becquerel laboratory in enhancing the status of photographic methods throughout the second half of the 19th century in Paris, concentrating on the creation of a particular sort of photographic observation that was all the Becquerels’ own.

56

**Alison Wylie**, University of Washington

*Archaeological Facts in Transit*

Archaeological facts travel in a number of senses, subject to the vagaries of preservation, accidental recovery, curation, and circulation. My focus here is on how archaeologists who study the earthen mound sites located in the central river valleys of North America – Hopewell and Mississippian sites – grapple with the effects of continuous trade in and dispersal of the material with which they work. These sites have been studied intensively and, over the course of 150 years, successive generations of archaeologists have selectively retrieved and curated, analyzed and narrated facts of the record and facts of the past in very different ways. Many of these facts have proven to be ephemeral and highly malleable; they are vulnerable to destruction and dispersal, or to reinterpretation as research traditions evolve. Some, however, are strikingly robust; they become iconic, prized as rare or representative, or as emblematic of particularly resonant conceptions of pre-contact Native America and, in this, virtually impossible to dislodge or revise. I examine how the transit of archaeological facts – from in situ depositional contexts to archaeological repositories, across institutional contexts and legal jurisdictions, in and out of the public domain – delimits the scope of archaeological inquiry and determines, in turn, what will count as a durable fact of the past.

**Elizabeth Yale**, Harvard University

*Papering the Counties: Circulation and Use of Query Lists in Seventeenth-century British Natural History*

In this paper, I argue that seventeenth-century naturalists and antiquarians developed the information gathering unit of the “query” in response to the intellectual and social priorities engendered by the Baconian sensibility dominating those fields in the latter seventeenth-century. As described by Barbara Shapiro and others, this sensibility encouraged wide-ranging “incremental fact gathering” as a method for constructing histories of nature and antiquities. In order to facilitate their work, naturalists drew up lists of queries and circulated them as printed and hand-written texts. Lists of generic queries were printed in the *Philosophical Transactions*. Naturalists like Robert Plot and Edward Lhwyd printed and distributed thousands of broadside query lists as they prepared regional histories of nature and antiquities. Henry Oldenburg, and others, drew up query lists by hand in order to provision well-placed commercial and diplomatic travelers who also happened to be patrons of the Royal Society. Naturalists exchanged individual queries through correspondence. As these examples suggest, the “query,” and the “query list” were tools used to produce both natural knowledge and social relationships. As knowledge-making tools, they allowed naturalists to standardize their information gathering across time and space, and instruct potential respondents in the kinds of facts and observations desired. As social tools, queries and query lists linked naturalists through correspondence, becoming another kind of currency that naturalists exchanged with each other in order to build and maintain relationships within the natural historical and antiquarian communities.

**David Zitarelli**, Temple University

*Mathematics at World's Fairs: Chicago 1893 and St. Louis 1904*

World's Fairs held at Chicago in 1893 and St. Louis in 1904 borrowed the idea of sponsoring an academic congress from the Paris World's Fair of 1889. Both of these two American congresses contained a mathematics component in spite of the country's backwater status at the time, and both of these congresses had the potential at least to suggest directions in which American mathematics might proceed. This talk will compare various aspects of the international nature of these congresses, including the invited speakers, their addresses, additional activities (notably displays of physical models), and prior arrangements and post-congress tours. In particular, it will compare and contrast the roles and the impacts of the key foreign participants – the German mathematician Felix Klein at the Chicago Congress and the French mathematician Henri Poincaré at the St. Louis Congress – on the American mathematical community. In so doing, it will highlight the reasons why the Chicago Congress had a substantially greater influence than the St. Louis Congress not only on the development of mathematics in the U.S. but also on the self-conscious efforts of American mathematicians to participate competitively in what many increasingly viewed as the international mathematical arena.

**Karen Zwier**, University of Pittsburgh

*John Dalton: From Puzzles to Chemistry by Way of Meteorology*

Historical research on John Dalton has been dominated by an attempt to reconstruct the origins of his so-called “chemical atomic theory”. This enterprise has encountered much difficulty, often blamed on the poor condition, uncertain chronology, and contradictions of extant manuscripts. Although difficulties with the Dalton manuscripts are a serious problem for historical research, I argue that there is a much greater problem in the existing literature: the misguided assumption that Dalton's research was guided by the pursuit of the chemical atomic theory. In this paper, I cast doubt on methods which attempt to summarize the atomic theory in a concise way. I also criticize any approach which views Dalton's atomic theory as the pinnacle of his career toward which all his prior research was supposedly directed. I propose a different approach that makes use of the manuscripts in a more productive way, and results in a better picture of his life and research. I show that Dalton's chemical work grew out of two previous interests that he maintained throughout his entire life: puzzle solving and meteorology. A childhood fascination with solving intellectual puzzles shaped his approach when he took up an interest in meteorology in his twenties; Dalton then began to see the constitution of the atmosphere as a “puzzle”. In working on this great puzzle, he gradually turned his interest to specifically chemical questions. In the end, the puzzles that he worked on required him to create his own novel philosophy of chemistry that he is known for today.