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"A Totally Unqualified Woman": Gender and the Policing of Science in the IGY Expedition to South Georgia

Daniella McCahey  
University of Idaho

In 1956, the Royal Society and the Falkland Islands Dependencies Survey collaborated to send a small expedition to make glaciological observations on the sub-Antarctic island of South Georgia during the International Geophysical Year. Jeremy Smith thought his partner, Richard Brown, to be lazy and unqualified for the work. Brown considered Smith to be fanatical, misogynistic, and incapable of social propriety. The two scientists fought incessantly. At the center of much of their discord was Brown’s wife, Elizabeth. Elizabeth Brown’s inclusion on this expedition places her in an anomalous position, as Britain forbade women full access to Antarctica until 1996. Smith found her presence intolerable and after months of complaining, managed to have Brown dismissed and the couple returned to London. Smith’s results were never published. This expedition can tell us a lot about the state of British glaciology in the 1950s, including its low priority for the British government, the lack of qualified geologists willing to go to Antarctica, and the dwindling relevance of small scale glaciological surveys to the greater field. Most importantly it shows how the social boundaries of science were drawn by those practicing it. Smith constantly dwells on what rights should be extended to him, as well as policing the behavior of those like Richard and Elizabeth Brown, who as non-formally trained scientists, should not be on a Royal Society Expedition. Through illegitimating their presence, essentially erasing the couple from official histories of the expedition, Smith validated his own self-estimation as a true scientist.

"Bringing the Bluegrass West: Scientific Agriculture and the California Thoroughbred Industry"

Brian Tyrrell  
University of California, Santa Barbara

Accidents of geology and history made Kentucky’s Inner Bluegrass region into one of the world’s premier areas for raising thoroughbred horses. Limestone-rich soils provided the region’s eponymous grasses with high levels of calcium and other nutrients that resulted in strong and fast-growing horses. Geology, ecological relationships, political economy, and human agency created the Inner Bluegrass in the image of the horse, but the areas of California that became thoroughbred havens did not enjoy the biological and geological advantages that propelled Kentucky to the forefront of the horse industry in the nineteenth century. Instead, twentieth-century California capitalists scooped up horses (because that’s what wealthy people did) and forced the landscape to support them with extreme techno-scientific intervention. With chemical fertilizers, standardized feed, and complex irrigation systems, Californians brought the Bluegrass to the West. California thoroughbreds embodied many things: social institutions, economic relationships, and chemical research, but they were also products of human imagination. Using a case study of a farm in San Diego County, I argue that wealthy Californians intervened in the material world to make the landscapes of their imaginations. The history of California is the history of land speculation. California was the land of boosters and that proved no different for the horsey set. Thoroughbred owners overcame the limitations of California geography to raise horses that rivalled Kentucky’s thoroughbred crop.

"China as a Field": Carl Bishop, Ji Li, and the “First Archaeological Expedition in China led by the Chinese Themselves”

Kuang-chi Hung  
Department of Geography, National Taiwan University

My presentation focuses on the archaeology expedition conducted by American archaeologist Carl Bishop in China during the early twentieth century. Based on the archival material currently housed at the
University of Pennsylvania Museum of Archaeology and Anthropology, the Smithsonian Institution Archives, the Freer Gallery of Art, and the American Museum of Natural History, it details who Bishop was, his associations with the Smithsonian institution and the Freer Gallery of Art, how the associations as such brought Bishop to China, and how—and why—Chinese archaeologist Ji Li received Bishop’s incessant support. Although the history of field science has become a thriving subfield in the history of science, I argue that what concerns researchers largely remains what scientists in history had done in the field, instead of how they had constructed a site as a field for science. I argue that as long as researchers can scrutinize what constitutes a field from an ontological viewpoint, instead of confining themselves to what takes place in the field as if the field were merely a stage, they could better answer why “field” becomes such an important site for producing scientific knowledge.

"Collecting Evolution in the Galapagos and Rebuilding the California Academy of Sciences"

Matthew James
Sonoma State University

From June 1905 through November 1906, a full 17 months, the California Academy of Sciences in San Francisco sent out a group of eight sailor-scientists and three crew members on the schooner Academy to the Galapagos Islands to collect more and better specimens than Charles Darwin, or any other expedition, had collected in the past. While gone, the April 18, 1906 earthquake and fire destroyed their museum. The Academy collectors were unconstrained either logistically by their Ecuadorian hosts, or conceptually in terms of conservation. They believed, with some clear evidence, that time was running out and it would be a “damnable shame” if the emblematic giant land tortoises of the archipelago were to become extinct due to human and feral animal depredation. With the 78,000 specimens they collected, they brought the Galapagos back to San Francisco. Although they engaged in salvage zoology with the tortoises, they also collected, through the taxonomic specialties of the eight young collectors, a broad spectrum of the terrestrial biota. They caused no species to go extinct, with arguably one exception. With both vertebrates and invertebrates studied by taxonomists after the expedition, the biological material they collected has vindicated Charles Darwin.

“Eating Electricity and Delivering India”: Cultural Resistance and Electricity in Late-nineteenth Century Bengali Drama

Animesh Chatterjee
Leeds Trinity University

The arrival of electricity as an everyday scientific and technological phenomenon into colonial Calcutta from the late-1870s onwards coincided with the emergence of the Bengali theatre as a physical and metaphorical stage to publicly portray, discuss and debate the contemporary social, cultural and nationalist issues of the emerging Bengali middle classes. This paper examines the place of electricity in Bengali theatre - not just in the physical spaces, but also in its plays and language - as an explanatory and metaphorical tool in literary and dramatic responses to the complexities of contemporary Bengali middle classes. It will study how electricity and electrical technologies served as tropes signalling wider Bengali middle-class anxieties over colonialism, identity, autonomy, nationalism and technological modernity, especially in the perception and portrayal of domestic electrification as a harbinger of radical change that could disrupt long-established 'Indian' cultural values within the Bengali household. Bengali dramatists, it will be shown, added their own interpretations of electricity, as well as their hopes and fears of its influence on the Bengali individual, family and society. While the works of Bengali dramatists and satirists are the main focus of this paper, I also use other forms of nationalist writings and imagery to explore how allusions to electricity in Bengali drama reflected not only anticolonial resistance to Western technologies in the Bengali domestic sphere, but also revealed ideological contestations within sections of
the Bengali middle class on notions of modernity, tradition and the nation.

“Esperienza,” Teacher of All Things: The Musical Art-Science of Vincenzo Galilei

Adam Fix
University of Minnesota

Was Vincenzo Galilei—composer, lutanist, and father of Galileo—an experimental scientist? Historians of science and music alike have agonized over this question. In 1589, Vincenzo recounted observations, taken from sonorous objects including lute strings and organ pipes, that seemed to contradict classical laws of harmony. Intriguingly, he claimed to have obtained these results from "the teacher of all things": 'esperienza delle cose maestra.' Vincenzo’s word ‘esperienza’ has been translated as "experience" or "experiment" based on whether it appeared in practical contexts—dealing with composition and performance—or speculative contexts—concerning the natural cause of musical consonance. My talk reinterprets Vincenzo’s approach to music as a dual speculative/practical research program. Extending beyond scientific experimentation as usually defined, Vincenzo’s notion of ‘esperienza’ entailed a balancing of mathematical reasoning, sense perception, and instrumental skill that bridged the chasm between musical sciences and arts. Just as Vincenzo used instruments to disprove contemporary theories of harmony, he implored musicians to deploy ‘esperienza’ towards the composition of ‘vera musica,’ or the "true music" given in nature. In short, Vincenzo proffered a musical art-science in which theory and practice converged towards the formation of natural knowledge. His vision of ‘esperienza’ would inspire many experimental philosophers in the following century, most notably his son. My talk, by investigating the musical roots of experimental philosophy, demonstrates how entangled premodern speculative science and musical practice truly were.

In 2003, the fossilized skeleton of a new member of the human evolutionary family was unearthed on a remote island in Southeast Asia. This small skeleton surprised the discovery team of international scientists, causing them to fiercely disagree over the significance of creature’s tiny brain, primitive features, and implications for human evolution. The skeleton raised many challenging questions about the human past—including an alarming possibility that the tiny creature had suffered extinction by the hands of humans. The debate was not limited to the skeleton’s intellectual substance, however, but also became intertwined with the culturally and politically loaded problem of who would analyze the bones. This paper examines the entangled intellectual and physical struggle over the bones of Homo floresiensis from 2004-2010, the years the conflict received international attention and became labeled a fossil “tug of war.” I explore how the question of ‘what does it mean to be human?’ became conflated with the question of ‘who decides?’ I argue that examining the skeleton’s discovery location, Indonesia, in a post-colonial context is crucial to understanding the conflict. This paper contributes to scholarship that explores the circulation of knowledge in the form of objects. I argue that hominid fossils provide a unique dimension to the discussion, as their delicate status often prohibits them from circulating. The bones are therefore tied to particular geographic, cultural contexts that shape the debates and ultimately the knowledge generated regarding our origins and ourselves.

“How Do I Know... Prayers Don’t Do More Good than... Pills”: Don Pedrito Jaramillo, Curanderismo, and the Rise of Professional Medicine in the Texas-Mexico Borderlands over the Turn-of-the-Century

Jennifer Seman
Metropolitan State University of Denver

This paper will explore the relationship and tensions between curanderismo—a traditional Mexican faith-
healing practice-and professional medicine in the Mexico-Texas borderlands over the turn of the century by examining both the Mexican and U.S. government’s attempts at regulating healing practices during this period. This paper will focus on one curandero, Don Pedrito Jaramillo (1829-1907), who crossed the border from Mexico into Texas in the 1880’s and healed ethnic Mexicans on both sides of the border, while also drawing attention from professional medical associations, such as the American Medical Association and professional physicians in Northern Mexico, yet all the while maintaining a reputation as a gifted and benevolent healer among the people living in this borderlands. During his lifetime many of his adherents considered him a “folk saint”-unsanctioned by the Catholic Church yet revered by the people he healed. This paper asks two questions: why was Don Pedrito Jaramillo such a popular healer among the people, and why did he draw the attention and ire of professional medicine? As scholars William Taylor, Frank Graziano, and Desirée A. Martín have shown, folk saint movements are strongest in places where institutions (government, church, professional medicine) are weak, such as the U.S.-Mexico borderlands at the turn of the twentieth century. Yet, as this paper will show, there was perhaps more in common between curanderismo and biomedicine than professionalizing medicine would acknowledge in this period where official institutions attempted to project their power and dominance into the borderlands.

"Humanistic" Science, "Scientific" Humanities: Towards an Integrated History of the Humanities and Science

Kristine Palmieri
University of Chicago

The modern research university is divided into three distinct branches: the natural sciences, the social sciences, and the humanities. This particular constitution is far from evident, as the nature of knowledge and the relations between different realms of knowledge have been regularly redefined throughout history. In this session, we trace the shifting boundaries between the sciences and the humanities in the long nineteenth century. Historiography on this period is characterized by accounts of specialization and professionalization that, above all else, focus on the development of the sciences or the humanities. This panel aims to place these two distinct historiographical traditions into conversation with one another by presenting four case studies in which the boundaries between “science” and “humanities” were blurred. None of our case studies can be placed in either the history of science or the history of humanities exclusively, they bear relevance to both. They question what it means for a certain knowledge practice (or practices) to be ‘scientific’ in different times and different places. Furthermore, they show how the history of science can be enriched by insights from the history of humanities, and vice versa. These case studies shed light on overarching questions such as: How has our notion of what belongs to the sciences or the humanities been established? How has this changed throughout the long nineteenth century? How have different groups of scholars carved out new niches between the sciences and the humanities to the example of, or in contradistinction to, other professional groups?

"I Remember When the Russian Satellite Fell": Cosmos 954 and the Shape of Northern Nuclearity, 1968-1979

Lisa Ruth Rand
University of Wisconsin-Madison

In January 1978, a nuclear-powered Soviet satellite plunged from orbit. Radioactive fragments of the spacecraft landed in a region of the Canadian Arctic known as “the Barrens.” Canadian state officials and journalists alike expressed relief that the accident had occurred in a place seemingly devoid of life, human or otherwise. However, Dene and Inuit communities that depended on local subsistence faced very real danger of exposure. The Cosmos 954 incident marked only one of several nuclear accidents to take place in the North American Arctic, threatening
Northern Indigenous communities whose experiences were in turn largely erased from contemporary and historical accounts. Conflict between settler experts and Indigenous knowledge were complicated by problems of linguistic and cultural translation. As the joint Canadian-American cleanup team descended upon the Barrens, the threat of radioactive contamination forced Indigenous communities in which the very vocabulary of the Space Age did not exist to participate in novel debates over space governance—and to contribute to liability negotiations between the Canadian and Soviet governments. Meanwhile, claims of “natural” radiation in the region allowed nuclear experts attempting to identify and quantify traces of the satellite within a broadening vertical and circumpolar nuclear continuum to dismiss Indigenous concerns about exposure to the satellite’s remains. Outsider expertise subsumed the embodied experiences of individuals living in proximity to the radionuclides in question—whether in the form of natural uranium ore, in the cells of lichens and tissues of caribou, or falling from the sky.

In 1912, ethno-botanist Melvin Gilmore met with White Horse, an elderly member of Nebraska’s Omaha Nation. White Horse described the terrible transformation he had seen in his lifetime: “Now the face of all the land is changed and sad. The living creatures are gone. I see the land desolate, and I suffer unspeakable sadness.” This presentation draws on early twentieth-century research from ethnographers, geographers, and government officials, as well as contemporary oral history, to examine the interplay between Omaha and Euro-American understandings of lands and peoples in the nineteenth and early twentieth centuries. The first half of this presentation focuses on the indigenous perspective. The Omaha were not only hunters, but also industrious farmers of corn and vegetables, and their spiritual system understood the earth as a vibrant, living body. As the land filled with settler farmers, it seemed, paradoxically, to empty and wither. The second half of this presentation takes up Euro-American obsessions with productivity, which, conversely, understood Omaha lands as empty and unused until brought into a Euro-American style of agriculture. These competing cosmologies came into high relief with a 1910 government competency commission, which assessed each member of the Omaha Nation, including White Horse, to determine whether their lands should be held in trust; individuals’ competency was determined in large part by their commitment to sedentary farming. Shifting rubrics of ableism evaluated individuals and lands through Euro-American sciences of agricultural efficiency, leaving only the Omaha and their ethnographers to recognize the awful desolation settler-colonialism had engendered.

“I See the Land Desolate”: Competency, Agriculture, and the Omaha Nation

Caroline Lieffers
Yale University

In 1912, ethno-botanist Melvin Gilmore met with White Horse, an elderly member of Nebraska’s Omaha Nation. White Horse described the terrible transformation he had seen in his lifetime: “Now the face of all the land is changed and sad. The living creatures are gone. I see the land desolate, and I suffer unspeakable sadness.” This presentation draws on early twentieth-century research from ethnographers, geographers, and government officials, as well as contemporary oral history, to examine the interplay between Omaha and Euro-American understandings of lands and peoples in the nineteenth and early twentieth centuries. The first half of this presentation focuses on the indigenous perspective. The Omaha were not only hunters, but also industrious farmers of corn and vegetables, and their spiritual system understood the earth as a vibrant, living body. As the land filled with settler farmers, it seemed, paradoxically, to empty and wither. The second half of this presentation takes up Euro-American obsessions with productivity, which, conversely, understood Omaha lands as empty and unused until brought into a Euro-American style of agriculture. These competing cosmologies came into high relief with a 1910 government competency commission, which assessed each member of the Omaha Nation, including White Horse, to determine whether their lands should be held in trust; individuals’ competency was determined in large part by their commitment to sedentary farming. Shifting rubrics of ableism evaluated individuals and lands through Euro-American sciences of agricultural efficiency, leaving only the Omaha and their ethnographers to recognize the awful desolation settler-colonialism had engendered.

“Ikan Bagai Makanan”: Ishak bin Ahmad and the Feeding of Malay Nationalism, 1923-1941

Anthony Medrano
Harvard University

While fish fueled the making of modern Southeast Asia, they also fed the growth of Malay nationalism. This paper looks at the relationship between fish and politics through the career of Ishak bin Ahmad (1887-1969), a fisheries scientist who became the first non-European to head a department in Malaya in the 1930s. It tells a different kind of science story, one that narrates how Ishak’s labor as a fisheries expert shaped his life as a Malay nationalist. Drawing on multilingual sources, the essay argues that Ishak’s knowledge of food fish, investigations on scientific surveys, encounters with Japanese fleets, and concern for Malay fishers mobilized his political work in interwar Singapore. After moving to the city in 1923, Ishak became a founding member of Kesatuan Melayu Singapura (KMS), Singapore’s first Malay political association established in 1926. By the late 1930s, Ishak was serving not only as Malaya’s Director of Fisheries and as vice-president of KMS,
but also as a broadcaster of a Malay-language radio program that popularized effective fishing methods and the value of “fish as food” (“ikan bagai makanan”). Ishak’s son, Yusof (1910-1970), joined KMS too and co-founded Utusan Melaya in 1938, the first Malay-owned, Malay-language newspaper that, among other things, championed the plight of Malay fishers and documented the conditions of Malayan fishing. By tracing the arc of Ishak’s life, this paper thus shows how local scientists leveraged their expertise and mobility in ways that not only captured colonial opportunities, but also, and more importantly, cultivated national horizons.

“In Imperfect, Inequitable, and Precarious”: Rationalizing the South Asian Monsoon, 1886-1930

Sarah Carson
Princeton University

This paper isolates the most controversial of the India Meteorological Department’s (IMD’s) activities: long-term forecasting for the South Asian subcontinent. Responding to international pressure and imperial anxieties following horrifying famines, in 1886 meteorologists commenced annual issue of monsoon predictions months in advance focusing on merely one variable: rainfall. The project involved the coordination and standardization of rainfall registration systems already carried out by provincial governments, the calculation of statistical precipitation normals, and experiments with prognostication. This latter endeavor was new to scientific—that is, quantitative and centrally systematized—meteorology in the late nineteenth century. But object of this study—the monsoon, itself partly constructed in culture and language—slipped into and out of sight, its definition unsettled and dependent on the community. The phenomenon repeatedly eluded scientific pre-vision, undercutting the local authority of the institution and its scientific practices. In addition, certain South Asian publics criticized general monsoon predictions’ utility for decision-making on regional or local scales. To probe the complex entanglements of geography, institution-building, imperialism, prognostication, and atmospheric phenomena in this history, I highlight repeated controversies in the production and reception of the printed forecast between 1886 and 1945, as they played out between departments in imperial administration and in South Asia’s newspapers. I argue that although the seasonal forecast was the most compelling justification for the IMD’s national and global importance, its limitations weakened popular trust in modern meteorology.

“In Truth and Service,” Black Academica’s Use of Eugenic Science in HBCU Classrooms and Culture, 1910-1940

Bridgette Robinson
Prince George’s Community College

At the turn of the twentieth century, Historically Black Colleges and Universities stood as symbol of racial pride for black America. They were also a place where intense missions dedicated to uplift ideology were weaved into tradition collegiate curriculums. This paper will look at the development of HBCUs in terms of fusing eugenic application and respectability in teaching ‘fitness’ through proper manners and morals. It will also examine eugenic courses at HBCUS through institutions such as Fisk University, Howard University and Tuskegee Institute. From Du Bois’s “Talented Tenth” theories to Washington’s definition of New Negroes, the black intelligentsia embraced various forms of eugenic science as a means in which to create not just scholars, but future exemplars who would continue the tradition of race uplift work. By tracing the endorsement of eugenic theory by affluent black leaders and institutions, this work will challenge the afro-centered perspective that blacks were always acted upon during the peak years of American eugenic reform.

“Man’s Role in Changing the Face of the Earth”

Emilie Raymer
Johns Hopkins University

In 1955, an influential group of scholars, who included historians, geographers, ecologists, and
zoologists gathered at the Princeton Inn for the international symposium “Man’s Role in Changing the Face of the Earth.” Sponsored by the National Science Foundation and the Wenner-Gren Foundation for Anthropological Research, conference participants examined “man’s evolutionary dominance” and the changes he wrought on the “physical-biological environment.”[1] Among the topics they explored were deforestation, soil erosion, waste disposal, and energy use. The late Oxford geographer Michael Williams identified that the symposium “validated the interdisciplinary approach, heightened the environmental consciousness in the English-speaking world, and exerted an unprecedented influence on the development of a unified approach to environmental issues.” However, little historical attention has been devoted to “Man’s Role.”[2]

In this panel, we explore the environmental, social, and political issues that “Man’s Role” participants wrestled with, and we examine the intellectual legacy of the symposium. Simon Torracinta places the conference within broader debates about decolonization and universalist humanism. Jonathan Phillips identifies new evolutionary theories forged during the Cold War era and discussed at “Man’s Role.” Zachary Loeb examines the technological and ethical critiques Lewis Mumford issued at the symposium. James Bergman draws connections between the work of Paul Sears, R.J. Russell, C.W. Thornthwaite and that of nineteenth-century environmentalist George Perkins Marsh. And finally, Emilie Raymer suggests that “Man’s Role” precipitated interdisciplinary dialogues about anthropogenic environmental change.


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“Management” of the Squirrels of Washington, D.C., from the 1950s to the 1980s: Historical Case Studies in the Human-Animal Bond, Nonhuman Charisma, and Network Analysis

Helena Pycior
University of Wisconsin-Milwaukee

“Presidents might come and Presidents might go, but the White House squirrels presumably could go on forever,” Richard Neuberger told his Senate colleagues in a 1955 speech condemning relocation of some squirrels to distant areas. Neuberger referred to the Eastern gray squirrels living on the White House grounds, who have amused and challenged presidents and staff at least as far back as Teddy Roosevelt’s administration. Publicized by Neuberger, relocation of these charismatic squirrels set off a firestorm, leading to framing of a history-dependent rationale for the special standing and protection of White House squirrels. This paper compares and contrasts: (case 1) the aborted relocation of White House squirrels and (case 2) relocation of nearly eighty squirrels living in Lafayette Park (across from the White House) in the 1980s. Adopting a network approach to Lafayette Park, wildlife experts documented interactions within an assemblage of the park’s squirrels, rats, pigeons, dedicated human provisioners of peanuts, trees, animal welfare groups, etc. Case 2–resolved with squirrel removal–evidenced the limits and challenges of early network analysis. Both cases involved the human-animal bond. Whereas in case 1 the human-squirrel bond played a key role in the squirrels’ protection, in case 2 emphasis on preservation of “historic landscaping themes” led to the squirrels’ relocation. In case 1 ecologists worked with the human-animal bond; in case 2, around the bond. The paper analyzes situational nonhuman charisma, convenient fluidity in animal classification (squirrels as pets, wild animals, and pests), and challenges to the application of network analysis.

“Negative Miracles”–Lewis Mumford and Man’s Role in Changing the Face of the Earth
When Carl O. Sauer and William Thomas began planning the “Man’s Role in Changing the Face of the Earth” conference, they initially envisioned it as being a celebration of the 19th century conservationist George Perkins Marsh. As such, it seemed obvious to Sauer and Thomas that they could not put on a “Marsh Festival” without inviting the man they credited with re-discovering Marsh, namely: the social critic Lewis Mumford. Accepting the offer to help organize the event, and to be one of its three co-chairs, Mumford was involved in drafting lists of invitees and commenting on the shape and general tone of the conference. In particular, Mumford pushed his fellow organizers to invite speakers who would emphasize the question of ethical responsibility, who would consider the risk of irreversible technological damage to the natural world, and—most importantly—who would raise the question as to whether or not the urge to control the Earth had in the end been self-defeating. An active participant in the conference’s discussions, Mumford chaired the “Prospect” section of the conference, and was given the honor of delivering the event’s closing comment. An honor Mumford used to darkly muse “I would say that man’s future seems black, though perhaps a shade lighter that it was five years ago.” Drawing upon original archival research conducted using the Wenner-Gren Foundation Archives and the Lewis Mumford Papers, this paper will consider Mumford’s role in organizing the “Man’s Role” event, and on how the conference fits into Mumford’s oeuvre.

“Now is the Time to Collect: Museums and Salvage Zoology at the Turn of the Twentieth Century”

Paul D Brinkman  
North Carolina Museum of Natural Sciences

In the last half of the nineteenth century, Western scientists expected the global extinction of large game animals as a consequence of encroaching human activities, especially land-intensive practices like farming and ranching. Extinction was seen as the inevitable, if lamentable, byproduct of humanity’s steady advance. In other words, the permanent demise of some species was a pity, but the loss was a small price to pay to maintain the pace of progress. Animals that went extinct were simply outcompeted in the struggle for survival. Museum zoologists of this era practiced salvage zoology. Their role was to secure the remnants of these threatened animals–skins, skeletons, eggs, nests and whole animals–while they could still be acquired, and preserving them as museum specimens for all time. The rationale behind salvage zoology was clear: certain animals were doomed to extinction by the unrelenting spread of Western civilization. Zoologists, therefore, were obligated to harvest their specimens and keep them in museum collections. Museum zoologists in the 1890s were motivated more by the potential loss of scientific information than they were by the loss of species. Museums would have to act quickly, for the pace of extinction was quickening and many believed that the window of opportunity for collecting specimens would not remain open for long. An additional impetus for the fervent collecting ethos was a burgeoning movement to protect endangered animals in the late nineteenth century, which was seen by museum zoologists as an unfortunate impediment to collections-building.

“Of Course, it was Really a Male”: Unknowing Sexual Multiplicity in Nineteenth-century Animal Studies

Beans Velocci  
Yale University

Before sexologists started to taxonomize human sexual differences, studies of non-human animals served as an important site for explorations of the meaning and manifestation of sex. Nineteenth-century scientists routinely debated what forms of sexual difference constituted natural variation and what forms signaled mistakes, disease, and monstrosity. Exemplary specimens filled the pages of scientific journals and popular science magazines–hermaphroditic oysters, neuter bees, ambiguously sexed hyenas, and sterile cattle, among others, formed a seemingly endless
parade of nature’s departure from a coherent sexual classification scheme. In the process of distinguishing variety from pathology, knowledge producers negotiated a choice: shift their understanding of sex to include categories beyond male and female in light of specimens that didn’t fit a binary model, or declare anything not clearly male or female and frame the exceptions as proving a binary rule. Most chose the latter. But if so many specimens gave evidence to inadequacy of binary sex to describe the variation found in nature, how did scientists continue to employ a binary framework? How did they justify the maleness or femaleness of various specimens, or the commonness of clear lines between male and female, when the pages of medical and zoological journals were filled with species that seemed to arrange themselves in other ways? This paper examines the processes of classification, and the stakes of scientific racism that depended on an understanding of primitivism defined through sexual ambiguity, that enabled the preservation of a binary sex ideal despite considerable evidence to the contrary.

**“Our Destiny and Our Duty”: Evolution’s Role in Man’s Role in Changing the Face of the Earth**

Jonathan Phillips  
*Johns Hopkins University*

Against the backdrop of the Cold War, several midcentury biologists worked to radically revise the basic idea of evolution, broadening it far beyond its traditional scope. Drawing heavily on the work of French paleontologist and idiosyncratic Jesuit theologian Pierre Teilhard de Chardin, biologists including Julian Huxley, Theodosius Dobzhansky, and G.G. Simpson redefined evolution as a universal process encompassing all change over time, from the cosmic level to the cultural. This redefinition served to support an urgent conclusion: that humanity had replaced natural biological and geological processes to become the primary agent of evolutionary change. In this paper, I will explore how this understanding of evolution—explicitly adopted by a number of organizers and participants— informs the Wenner Gren Foundation’s 1955 conference, Man’s Role in Changing the Face of the Earth. The ongoing interplay between the life and social sciences in the wake of that conference can be observed in the 1959 Darwin Centennial Celebration at the University of Chicago, an event ostensibly intended to delimit and define the discipline of evolutionary biology one hundred years after the publication of On the Origin of Species, but which included a number of the anthropologists from the Man’s Role conference, including Sol Tax, the Darwin Centennial’s organizer. Contextualized in larger contemporary discourses, these conferences can be used to trace the migration of ideas from evolutionary theory and outré Catholic theology into social scientific, ecological, and environmental thought.

**“Playing the White Man’s Game”: Francis La Flesche, Indigenous Ethnology, and Queer Failure**

Eli Nelson  
*Williams College*

Omaha ethnologist Francis La Flesche (FLF) has been remembered either as an unsuccessful supporter of the settler project or a misunderstood subversive social scientist. Before his appointment with the U.S. Bureau of Ethnology in 1910, FLF worked for three decades with ethnologist and allotment agent Alice Fletcher as a native informant, an epistemic tool whose gender, age, and subjectivity were rendered mutable. As the first Indigenous professional ethnologist, FLF studied the Osage nation extensively, but his scholarship and artifact collections were deemed “incomprehensible” and pedantic. His published works relied on Osage categories, lacked legible theoretical contributions, and his collections were undisplayable. Even FLF’s professional presence was evidence of the failure of the inner logics of his field, which presupposed his destined vanishing. In this paper, I challenge this historical narrative in which one can only resist or collude with cis-heteronormative colonial sciences. I read FLF’s failure, the fact that he was never quite the proper subject of settler scientific knowledge production, as
part of the making of Indigenous ethnology. Using J. Halberstam’s construction of queer failure, in which failure “exploits the unpredictability of ideology” and “recognizes that alternatives are embedded already in the dominant,” I argue that this never-quite-ness was not just an absence of authority, but a Native scientific position. Using a queer interpretive lens, I explore FLF’s published works and personal correspondence relating to salvage, and question settler-normativity in the study of Native science— the epistemic production of the objects and tools of settler science.

“Sailing for Science: The Voyage of the Blossom”

Wendy Wasman
Cleveland Museum of Natural History

In 1923, just three years after becoming a museum, the Cleveland Museum of Natural History sent 16 men on an expedition to collect scientific specimens. The Blossom Expedition, named after Elizabeth Bingham Blossom who sponsored the voyage, set out from New London, Connecticut, to explore the islands in the South Atlantic Ocean, including the Cape Verde Islands off the coast of Africa, and Ascension, St. Helena, and Fernando de Noronha off the coast of Brazil. After traveling 20,000 miles in nearly three years, the ship docked in Charleston, South Carolina, in June 1926 with 13,000 specimens that, in the words of the expedition leader, provided evidence to support Darwin’s theory of evolution.

“So Degraded in the Scale of Being”: Medical Concepts of Monstrosity and Defective Reproduction in the Nineteenth-century U.S.

Miriam Rich
Harvard University

Throughout the nineteenth century, American physicians and scientists invoked the term “monster” in efforts to collect, classify, and theorize the bodies of infants with extreme congenital anomalies. They also marshaled new frameworks of “monstrous” development to advance claims about racial hierarchy and degeneration. Drawing on medical and scientific publications, case histories, and preserved specimen collections, this talk will examine physicians’ interest in anencephaly, a terminally severe anomaly that featured prominently in studies of medical monstrosity. “Monstrous” anencephalic bodies were linked to concepts of race through a shared framework of development: just as these fetuses reflected an arrest or deviation in the course of embryological development, allegedly “lower” races reflected an arrest or deviation in the course of human racial descent. In this, monstrosity gained new specificity as a way for Euro-American theorists to articulate the nature of racial inferiority. Physicians and scientists also employed concepts of monstrous development to describe the precise mechanism of racial degeneration. Anencephaly was cast as the embodied endpoint of such degeneration, conceptualized as a slide down a hierarchical spectrum of human racial development. Medical discourse on monstrosity intertwined with burgeoning cultural fears about white Anglo-American decline: the figure of the monster, understood as a racial “reversion” produced by white and nonwhite mothers alike, exposed critical vulnerabilities of the racial order. Here, defective reproduction was configured as a key site of cultural and racial meaning-making within nineteenth-century medical science, preceding the seminal eugenic rhetoric that would later come to pervade American science, culture, and politics.

“Temperature, Humidity, and Movement”: The Crisis of Ventilation in Early 20th Century American Medicine

Caitjan Gainty
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In 1903, the Select Committee on Ventilation, appointed by Britain’s House of Commons, published a critical review of ‘modern’ ventilation systems. It decried the infamous lack of success engineers had had in ventilating the Houses of Parliament, but, more critically, it noted new statistical information showing that ‘impurity of the air is the most important cause of death’. The document made waves in Britain before traveling across the sea to the United
States, where it proved a vital weapon in the armamentarium of artificial ventilation’s detractors. Medical practitioners were quite often among those who eschewed and excoriated artificial ventilation as unhealthy, unsafe, unnecessary and impractical. This was the cause of great consternation among mechanical engineers especially, who despaired that leaving artificial ventilation systems out of hospital construction, or allowing them to lay dormant, was ‘retrogressive’. In cities whose inhabitants increasingly relied on, and breathed, artificial air, medical buildings which continued to rely on windows to provide air were worse than anachronistic. They were dangerously anti-modern. But medical practitioners had their reasons. This paper recounts the context and content of their resistance to artificial ventilation in the first decades of the 20th century. It highlights related contemporary debates in the construction of subways, ‘skyscrapers’ and other essentials of urban life. And it examines the impact of contemporary theories concerning ‘fresh air,’ which, drawing on air’s earlier status as primarily a therapeutic agent, made manifest the essential difficulties of deciding what ‘fresh air’ actually was in the first place.

“The Agency of Man on the Earth”: Cross-Disciplinary Studies about Anthropogenic Environmental Change

Emilie Raymer
Johns Hopkins University

In 1955, geographer Carl Sauer and geneticist Edgar Anderson were reunited in Princeton, New Jersey for the conference “Man’s Role in Changing the Face of the Earth.” Sauer, one of the conference organizers, delivered the paper “The Agency of Man on Earth,” in which he argued that although humans had always caused ecological damage, modern agricultural practices driven by industrial capitalism were particularly harmful. Consistent with his other work, Sauer painted in broad strokes, drew connections between ancient and modern man, and issued a scathing critique of contemporary profit-driven culture. In contrast, the paper of Edgar Anderson, “Man as a Maker of New Plants and New Plant Communities,” provided a careful study of how humans had cultivated vegetation. Anderson’s tone was diplomatic, and he concluded dispassionately that “man has been a major force in the evolution of plants and animals.” Although these two papers were, at least superficially, quite distinct, Sauer and Anderson had,
prior to the conference, formed a close friendship and had conducted expeditions to Latin America to collect and study indigenous maize samples. Sauer had inspired Anderson to consider humans as an active agent in biotic change, and in turn, Anderson had inspired Sauer to draw connections between macro and microevolution. And their mutual influence is apparent in their “Man’s Role” papers. Sauer and Anderson are just one example of the interdisciplinary collaborations that had taken place prior to the “Man’s Role” symposium. In this paper, I examine the relationship between Sauer and Anderson and explore some


Tasha Schoenstein
Harvard University

In response to the events in Chicago in 1968, several professional societies moved their annual meetings from Chicago to other cities, but the Association of Computing Machinery chose not to. In response, a group of computer scientists attempted to organize “The Counter-Conference,” a conference that would be held concurrently with the ACM’s 1971 meeting but would not be held in the Chicago area. The organizers’ choice to characterize the location of the ACM’s conference as a matter of professionalism in computer science reveals a vision for a socially-responsible computer science, while the failure of this conference to garner significant interest within the community of computer scientists reveals how computer scientists, like many academics in other disciplines in the late 1960s and early 1970s, rejected political engagement as an important aspect of academic professionalism.

“The Standard Head”: Identification, Formalization, and Standardization in an Early Facial Recognition Program

Stephanie Dick
University of Pennsylvania

The Kaplan Daguerreotype dates from the early 1840s and is thought by some to depict the young Abraham Lincoln. Competing authorities, from historians to reconstructive surgeons, have weighed in with their professional opinions as to whether or not the man in the image is the former president. In the early 1970s, a computer program developed at the University of Texas at Austin added its automated determination to the debate. The program did not settle the conversation, however, but instead highlighted just how difficult it was to formalize faces for automated recognition, especially among competing standards of identification. This talk explores that computer program, among the first of its kind, its design, and its place in conversations about automated identification from the daguerreotype debate to the New York State Police Department. For some forms of pattern recognition like letters and numerals, an automated point-by-point comparison could be relatively successful at the time. This method did not work well for faces, however, because photos of the same person differ a great deal point-by-point depending on factors like head rotation and lighting. The developers at UTA therefore sought to correct photographs for deviations from “face forward” before looking for a match. To do this, they introduced a “Standard Head” whose facial proportions would be assumed of all faces as a starting point from which to measure deviation and correct for rotation and tilt. The program serves as a window into the competing expertise and racial norms that characterized early automated facial recognition.

“There’s God is Their Belly”: Meat and Medicine in Seventeenth-century Rome

Bradford Bouley
University of California, Santa Barbara

In early seventeenth-century Rome, the per capita consumption of meat rose to nearly a pound per day. This enormous consumption was not just about luxury, but also spoke to the ways in which the papacy sought to remake its city and the bodies of its citizens in the wake of the Reformation. For a brief
few decades, to eat like a Roman meant either tacit or explicit acceptance on a range of ideas related to digestion, spirituality, the authority of medicine, and what it meant to live a "healthy" lifestyle. Through a survey of dietary advice, medical manuals, cook books, and autopsies performed on people considered to be both poor and healthy eaters, this paper will seek to explore the range of ideas related to this new dietary regime. Recent scholarship, including in particular work by Emma Spary and Karl Appuhn, has demonstrated that discourses on food reveal a great deal about how contemporary societies understood medical expertise, the body, digestion, and man’s interaction with his environment. This paper will seek to uncover such discourses and will demonstrate that the biggest battles in religion, politics, and even in medicine where waged with the most quotidian of objects: food.

“Theory, Observation, and Discipline: The Funafuti Expeditions as Crucial Experiments?”

Alistair Sponsel
www.studiesofscience.com

From 1896 to 1898 three Anglo-Australian expeditions were made to the Pacific atoll of Funafuti to test competing theories of coral reef formation, one published by Charles Darwin more than fifty years earlier and the other proposed by John Murray as a consequence of his research on the 1872-1876 voyage of H.M.S. Challenger. Darwin himself had died in 1882, but advocates of both theories favored a crucial test that he had suggested. The idea was to drill as deeply as possible into an atoll in an effort to determine, by bringing up cores, whether these formations were built up by shallow water corals that had accumulated atop a subsiding basement foundation of volcanic rock (as Darwin argued) or if atolls were formed by growth of corals atop accumulating banks of sediment. But the expeditions were framed as something bigger, as tests of Darwin’s broader geological perspective as it bore on his theory of evolution. As “crucial experiments” the expeditions were failures: no consensus emerged that the boring had settled the theoretical dispute(s) in question. In this paper, I examine the premise that boring a single atoll could conceivably resolve an interdisciplinary theoretical dispute, and argue that the “failure” of the Funafuti expeditions lay in incompatible ideas of parsimony between zoologists and geologists in the face of an absence of evidence to contradict Darwin’s reef theory.

“Three Million Defective Children”: Saving America with Prenatal Health Care, 1900-1930

Shannon Withycombe
University of New Mexico

Prenatal health care emerged in the early twentieth century amidst immigration anxieties, urban squalor, and global consciousness. As physicians and public health departments began to campaign for the medical surveillance of all pregnant women, they framed their arguments in terms of gender, race, nationalism, and civilization. While the practical advice provided by these newly-minted experts on pregnancy was virtually the same as it had been for decades (guidance on diet, rest, care of bowels, and clothing), medical personnel attempting to convince pregnant women to seek medical attention as frequently as every two weeks throughout their entire nine-month pregnancies couched this advice in a new context, tapping into a new American psyche. Creating the image of “American” pregnancy as one of a white, native-born, middle or upper-class woman, doctors relied on comparisons to recent immigrants, “primitive” groups, and European populations to convince women of the importance of medical supervision during pregnancy, to save both their babies and the nation itself. This paper examines the rhetoric of prenatal care with a focus on the language and arguments employed by early twentieth-century physicians, which continue to shape both private and public policing of pregnant bodies, women’s rights, and reproductive justice.

“Tortoise because he taught us”: Animality and Humanity in Grey Walter’s Cybernetic Brains
In the late 1940s and 1950s the emerging field of cybernetics raised the possibility that machines might match humans in their cognitive abilities. Especially in Britain, where cybernetics enjoyed a close institutional relationship with neurology, figures like William Grey Walter constructed machines in order to mimic the functioning of the brain. In his robots, which he constructed out of discarded war electronics, Walter sought to recreate the structure and function of “brain waves,” the study of which had made his name as a neurophysiologist. By exploring how Walter’s robots played simultaneously with biological/mechanical and human/animal differences, I show how they allowed him to reassert a hierarchy of creation that confirmed man’s exalted position in the animal kingdom while simultaneously developing a radically new vision of what it meant to be human.

“To the Malcontent” as Key to Bruno’s Italian Dialogues

Edward Gosselin
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In April 1973 m, Lawrence Lerner and I published an article in Scientific American in which we argued that Giordano Bruno was not a scientist in the Galilean sense of the word. In November 1986, Lerner and I published another article in Scientific American, arguing that a root cause of Galileo’s Trouble with the Inquisition in 1632-3 was not just the formal similarity of The Dialogue on the Two Great World Systems with Bruno’s Ash Wednesday Supper but that the Dolphin emblem on Galileo’s title page caused the Church to think Galileo’s work carried a Brunonian message. My proposed paper, written after years of work and publications on Bruno’s religious ideas, sums up my understanding of his message to England in 1583-5, as he composed his five Italian dialogues there. The entirety of his message from the first, The Ash Wednesday Supper, to the last, The Heroic Frenzies, was a religious message that transcended the Copernican Theory that was at these works’ base. And, most important, The Ash Wednesday Supper’s proemial poem, “To the Malcontent,” introduced the religious message that Bruno world develop in all five Italian Dialogues. Consequently, this poem, never before fully understood or explained, was an introduction to all five of Bruno’s works, not just one.

“Watts” in a Home: Staging and Selling Domestic Electricity in Interwar Britain

Alona Bach
Dumbarton Oaks Research Library and Collection

The play “Watts” in a Home, written by Britain’s Electrical Association for Women (EAW) and first performed in 1930, stages a history of domestic electrical lighting in Britain between 1880 and 1930. The play bears similarities to other triumphalist “electrical propaganda” produced in a range of media during the same period. However, analysis of the play’s script, performances, and reception highlight the crucial dramaturgical role played by the physical presence of audiences of “Watts” in a Home. This paper accordingly situates the play in the history of electrical performances which focuses on the role of the sensing human body and its capacity to feel (via touch) and to see. In doing so, it argues that “Watts” in a Home is best understood not merely as a play, but rather as a hybrid play and demonstration, which presented its audiences with a history of domestic electrical lighting in order to instruct, amuse, and—most significantly—engage them in the act of visual sensing to convince them of the merits of electrical lighting. Investigating how “Watts” in a Home straddled the form of play and demonstration unites the histories of electrical spectacles with later electrical showroom demonstrations. It also complicates histories of interwar electrical popularization by attending more directly to the relationship between the form, content, and audience of interwar "electrical propaganda."

The publication of Hayek’s principal work in “theoretical psychology”—The Sensory Order—was the end of a thirty-years-long endeavor, that begun in Monakow’s Zurich neurological laboratories, passed through Vienna, and London, and was concluded at the Committee of Social Thought of the University of Chicago. In my paper, I will compare the major versions of this work: the 1920 student paper, the London drafts, and the final Chicago publication. Thus we will be able to reveal the different constellations of disciplines that were summoned, each time, to answer the question: “What is mind?”. We will be using Hayek as a common denominator that will enable us to see the differences between these intellectual worlds. While Hayek, in his travels in time and space, will be our informant, the concept of “Mind” will serve us as our magnifying glass. The mind has become an object to many different forms of knowledge: biology, psychology, philosophy, medicine, economics, and cybernetics. Therefore, studying the history of the “mind” is tantamount to the study of the fluctuating interfaces between the humanities, the life-, and the human sciences. Finally, we will take into consideration the strange temporality of Hayek’s work. This book is read as either a fossil from the nineteenth century, or as prophecy about the world of AI—but never as a contemporary work. This curious temporality, I argue, hides the intellectual shift that took place in the time it took Hayek to bring his term paper to the shape of a published book.

"You are Prejudicing Your Own Case": Women as Experts, Users, and Disturbances at the 1970 Nelson Hearings on the Pill

Christopher ChoGlueck
Indiana University-Bloomington

Following British officials’ recommendation to stop prescribing oral contraceptives linked to blood clots, US Senator Gaylord Nelson began collecting testimony from experts in 1970. He asked: Is the pill safe? Do women have enough information to make informed decisions? Histories of the pill and the women’s health movement remember these hearings as initiating the “pill scares” and resulting in the first insert for patients. Most memorable, however, are the allegations of sexist underrepresentation of women among the experts. Feminists from D.C. Women’s Liberation protested the hearings because no women testified in the first round. The senators dismissed these “disturbances” and suggested feminists were prejudicing their own case. By the end, only 4 women (of 36 experts) had appeared, none of whom were regular users. Historians have agreed that Nelson refused women patients’ the platform to speak, and some have further charged that that those women who did testify were uncritically “pro-pill.” While there is truth to these claims, they overshadow how gender norms about expertise shaped the testimony of the women who did testify. In this flashtalk, I will argue for the unique contributions of women as experts, such as providing gender-blind expertise, gender-based testimony as an expert-user, and gender-based criticism. Furthermore, I will explore how these gender norms excluded certain testimony, such as non-expert users, “emotive” appeals, and those “aggressive” disturbances. Primary sources include women’s testimony from the Nelson hearings and articles from the feminist publication off our backs.

A Hard Core: Architects and Science in the Research University

Theodora Vardouli
McGill University

This session explores architecture’s place in the postwar research university. Specifically, it examines academic architects’ adoption of scientific ideals and methods, their crafting of a scientific imaginary of architecture, and these trans-actions’ lasting effects on the discipline’s ever fluctuant intellectual and institutional definitions. Pertinent historical scholarship often portrays architecture’s postwar realignment—its flirtation with mathematics, computing, and the basic sciences—as an uncritical subscription to a culture of scientism, and rejects their
outputs as pseudoscientific. This session tactically suspends these categorical judgments to consider architecture’s self-fashioning as a science in a new historical and historiographic key. Taking as a premise the situated, contingent, and non-monolithic nature of both architectural and scientific practices, we ask: How did local epistemic and institutional cultures reflect in architects’ efforts to endow their field with scientific legitimacy? What images of postwar science are outlined by architects’ invocation of scientific theories and practices? What does the case of architecture, a field traditionally dominated by vocational traits, offer to debates about the demarcation between science, non-science, and pseudoscience? What analytical tools may best assist us in addressing the research university’s endemic modes of knowledge production and dissemination? What non-archival sites of historical inquiry (oral histories, ethnography, media archaeologies, etc.) may we explore in pursuit of these questions? What common historical and methodological ground can we draw between architectural history and the history of science? Ultimately, the session seeks to consider mutualities and exchanges between architecture and science as an open field for historical and historiographic inquiry.

A Publishing Machine: The Quest of Botanist P.J. Buc’hоз for Scientific Recognition in Enlightenment France

Marie-Claude Felton
McGill University

At a time when the learned public of Paris was increasingly captivated by the wonders of science and new discoveries, the publication of books and pamphlets became a means a choice for any “savant” to get the readers’ attention and, hopefully, gain recognition from the members of the Académie des Sciences. The story of Pierre-Joseph Buc’hоз (1731-1807), lawyer, physician and botanist and his quest for independence from the publishers and recognition from his peers affords a window into the world of publication and scientific authorship. Having published—mostly through his own means—more than 300 pamphlets and books, including 95 folio volumes, on various topics ranging from medicine, botany to zoology, Buc’hоз not only had to face the harsh financial, legal and material realities of publication, but also the rejection of the Académie, whose members accused him of simply copying the works of others. Were Buc’hоз’s works original? How and why did he publish on his own? How had the concepts of originality and plagiarism made their way into the discourse of scientific authorship in the 1780’s? Through the sad story of Buc’hоз and his battle against the Académiciens, his “sworn enemies”, this paper will help explore the forging of scientific authority and authorship in Enlightenment France.

A Science for “Man with a Capital-M”: Man’s Role and Anthropology in the Atomic Age

Simon Torracinta
Yale University

In the face of both decolonization and the threat of human extinction, many anthropologists in the Cold War sought to shake the discipline out of what they saw as its post-Boasian doldrums. In this paper, I use Man’s Role in Changing the Face of the Earth, the massive cross-disciplinary symposium of both social and natural scientists organized by the Wenner Gren Foundation for Anthropological Research in 1955, to examine the question of “history” in anthropology. The Wenner Gren sought to use Man’s Role to renew dialogue between physical and cultural anthropology towards a new, unified science of Man, “the first species significantly to affect the course of his own evolution,” for the Atomic Age. Man’s Role was to delineate a new, species-level natural history of mankind, an approach championed by natural and social scientists alike, from the historical geography of Carl Sauer and Richard J. Russell to the organismic models of ecologists like F. Fraser Darling and Paul Sears. I contrast this approach to the cultural-ecological and materialist emphasis on history placed by the multilinear “scientific evolutionism” of Julian Steward and his students grouped around the Mundial Upheaval Society, developed in precisely
this period though notably absent from Man’s Role. The conference’s conception of history as species-unity mapped onto a Cold War universalist humanism—what Eric Wolf derided as “Man with a capital M”—which starkly contrasted with the sympathies of Wolf et al. with the emerging politics of decolonization.

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**A Spectrum of Propaganda and Scientific Exchange: Sino-British Scientific Networks from World War to Cold War**

**Gordon Barrett**

*University of Oxford*

This paper focuses on a significant cluster of scientists based in the United Kingdom whose engagement with China stemmed from a mixture of socialism, scientific internationalism, and scholarly friendships. Some, like Joseph Needham and J.D. Bernal, were ‘ideological notables’ as well known for their left-wing politics as their academic achievements. They had high-level positions in international organizations, occupied prominent positions within networks of like-minded academics and activists and had public profiles extending far beyond the world of science. Others, such as Howard E. Hinton or Kurt Mendelssohn, might not have enjoyed the same fame but they were nevertheless well-established figures in their scientific fields. Their visits to China after 1949 therefore had not only scientific value, but also provided the Chinese Communist Party distinctive propaganda opportunities diffracted through the lens of scientific exchange. Yet there was also a third category that included scientists like Kathleen Lonsdale and Dorothy Hodgkin, whose interactions were not so overtly propagandistic but still benefitted both scientists and Chinese policymakers.

In all, such scientists’ engagement lay along a spectrum of different modes, incorporating elements of propaganda and scientific exchange in varying measures. Their common features and individual attractions highlight Chinese foreign policymakers’ and scientists’ priorities and interests from the latter years of the Chinese Civil War through to the early years of rapprochement and increasing international integration in the 1970s. This indicates that such scientists ought to be treated as a distinct group with its own characteristics and motivations rather than as identikit Socialist-world sympathizers.

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**A Table for Two?: Mo Meng Yim and the Origins of Forensic Medicine in Siam (Thailand)**

**Trais Pearson**

*Boston College*

At the end of the nineteenth century, the kingdom of Siam was beset by the threat of foreign imperial intervention. Unequal treaties restricted its sovereignty in matters of trade and finance and established extraterritorial legal protections for foreign residents. As the external threat of imperial incursion rose in the 1890s, the Siamese state turned inward and fixated on the specter of foreign violence against Siamese subjects. State officials invested in new forms of expertise—legal and medico-legal—in order to investigate unnatural deaths and to produce forms of forensic evidence that would meet the standards of foreign consular courts.

Against this backdrop of international intrigue, a Sino-Thai physician, Mo (Dr.) Meng Yim, entered the morgue of the Police Hospital. While laboring alongside British physicians who were appointed to give the proceedings a sense of objectivity, Meng Yim did the crucial work of not only conducting autopsies but of documenting the proceedings in ways that would be acceptable to both foreign consular courts and to this superiors in the Siamese Ministry of the Capital. This paper explores the life and especially the labors of Meng Yim as documented in the inquest files of the Ministry of the Capital, which record the multifaceted ways in which he translated, touted, and tested the authority of forensic expertise. Meng Yim’s story contains lessons about the subordinate status of indigenous scientists in the colonial world and the challenges of practicing and promoting Western medical science in an age when it was anything but definitive.
A Tale of Resilience: the Periodic System after Radioactivity and the Discovery of the Neutron

Annette Lykknes
NTNU-Norwegian University of Science and Technology

Presented in 1869, the Periodic System is still an icon in contemporary science, even though the understanding of elements and chemical reactions has evolved tremendously over the last 150 years. The resilience of the Periodic System to conceptual changes is remarkable, and the fine structure of how this frame of reference was perpetually renegotiated and stabilized by the scientific community is often explained as a result of the underlying atomic structure. The physicist Lise Meitner and the chemist Ida Noddack-Tacke were, in different ways, involved in discoveries and interpretations of the Periodic System. In 1934, both of them published an article on the system; Meitner in Die Naturwissenschaften—Noddack-Tacke in Angewandte Chemie.

How did early 20th century scientists navigate these times of reinterpretation? And what hidden meanings and values of the Periodic System were displayed through this process? In this paper, we will use the articles by Meitner and Noddack, written from the perspectives of a nuclear physicist and a chemist experienced in searching for undiscovered elements, respectively, to shed light on what the new discoveries and insights meant for the meaning and value of the Periodic System at the very beginning of the nuclear age in science—seen from the perspective of the nucleus and mass-energy relations and of the existence and identification of possibly numerous chemical elements.

A Visit to Biotopia: Genre, Genetics, and Gardening in the Early Twentieth Century

Jim Endersby
University of Sussex, UK

The early decades of the twentieth century were marked by widespread optimism about biology’s ability to improve the world, catalysed by promising new theories about inheritance and evolution (particularly Hugo de Vries’ mutation theory and...
Mendel's newly rediscovered ideas). In Britain and the USA particularly, an astonishingly diverse variety of writers took up the task of interpreting these new biological ideas using a wide range of genres. They produced a new kind of utopianism—the biotopias—that embodied a confidence in humanity's ability to reshape living things to meet our desires. Biotopias offered the dream of a perfect, post-natural world, or the nightmare of violated nature (often in the same text), but above all they conveyed a sense that biology was offering humanity unprecedented control over life. Biotopias often visualised the world as a garden perfected for human use, but their vision often entailed dispossessing, or even killing, “Mother Nature”. Influential examples include Charlotte Perkins Gilman’s Herland (1915), H.G. Wells’ Men Like Gods (1923), and J.B.S. Haldane’s Daedalus (1924). These writings allowed biology to function as public culture, creating talking and thinking about biology continue to characterise today’s debates over the impact of new biological breakthroughs.

**Advantages of Being a Scientific Outsider:**

**Stanford Ovshinsky's Discovery of Phase-Change Memory**

Lillian Hoddeson

_University of Illinois at Urbana-Champaign_

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**All Coherence Gone? A New Isaac Newton**

William Newman

_Indiana University_

One might expect that our knowledge about a figure as well known and influential as Isaac Newton would be in a settled state after some three hundred years of historical research. The present session reveals the reality to be quite the contrary. The world of Newton scholarship is in a state of radical ferment. Online, digitized editions have over the last two decades brought literally millions of words of original
Newtonian material to light, much of it previously available only in manuscript form. The combined resources made available by The Newton Project (Oxford University) and the Chymistry of Isaac Newton project (Indiana University) have made it possible to compose major new books that substantially revise, and in some instances overturn the existing views on Newton in a variety of fields. Mordechai Feingold and Jed Buchwald (chair of the session) wrote a foundational new study of Newton’s work on ancient chronology in 2012. Rob Iliffe’s substantial new book on Newton’s religion appeared in 2017. William Newman’s forthcoming book on Newton’s alchemy is appearing in 2018. Alan Shapiro’s ongoing work on Newton’s optics continues to explore the boundaries between the mathematical, physical, and philosophical realms of Newton’s work. Where does all this new research leave us? Does a single, unified thinker emerge, or rather a polymath who pursued multiple fields without attempting to combine them into a single purview? This session brings together four leading scholars in the attempt to address that issue.

All Too Human: Formalizations, Models, and Algorithms in the 20th Century Human Sciences

Jonnie Penn
University of Cambridge

This panel examines how in the second half of the 20th century, the human sciences employed mathematical, engineering, and computer sciences to model, formalize, and control the human mind and behavior. The simulation of social and mental processes was relevant for computer programming, the scientific study of human nature, and the development of new forms of governance. However, as these papers argue, the translation of the social and the human into a symbolic language was far from a straightforward process and exact sciences did not provide scholars with neutral, apolitical, and purely objective models and formalizations.

Alternatives to Fact

Henry Cowles
University of Michigan

Knowledge is more than the sum of its facts. Historians have shown how intuitions, beliefs, rituals, fictions, and other ways of knowing bolster the cultural authority of scientific thinking in every era. Despite the ubiquity and importance of these alternatives to fact, knowledge claims still tend to rest explicitly on forms of evidence cemented in scientific disciplines over a century ago. This holds for historians and scientists alike: despite recognizing diverse practices in knowledge production, the foundations of historical and scientific knowing remain stubbornly factual. In an age of “alternative facts,” a new definition of knowledge centered on non-factual processes seems both philosophically possible and politically urgent. This panel explores intellectual authority today in light of the histories of various alternatives to fact within the human and social sciences. Joanna Radin excavates “off-label” uses of early SSK in the mass market fiction of Michael Crichton. Henry Cowles examines the contested place of anecdotes in the “new psychology” that took shape
in the late nineteenth century. Myrna Perez Sheldon analyzes the role of hereditary “facts” embedded in eugenic sermons written and preached by American Protestants pastors in the early twentieth century. Benjamin Breen looks at the strange entanglements between occult communities and technologists in mid-twentieth century California. A synthetic comment by Cathy Gere will draw together shared themes from these four historical moments, suggesting how they might speak to current conversations—within the discipline and beyond.

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**Alum Analysis in Europe, 1750-1810**

John Christie

*University of Oxford*

The production of alum crystal constituted a major manufacturing and international trading market in Europe from late medieval times onward. Its major use was as a mordant, a dye fixative, which had the further property of brightening the colours which it fixed. It had additional uses in leather tanning, paper-making, and medicine. From its early days in the Papal States, where the ‘Roman Alum’ produced in Tolfa supported large communities of miners and traders, its manufacture spread to the German states, to Spain, Sweden, France and Britain.

The process of alum crystal production was a well-understood technique, despite the underlying chemical complexity of the several stages of production, and it appears to be the case that the chemistry of alum and its crystalline form only started to receive sustained attention from chemists around the mid-eighteenth century. This started with Stahl, then continued in Germany in the work of Pott, Marggraf and Klaproth. In Sweden it received further analytical attention from Bergman, and latterly, in the 1790’s and early 1800’s, from the French chemists Chaptal (by that time himself a manufacturer of alum crystal), Vauquelin, Thenard and Roard. My paper surveys this sequence of analytical attention to alum, differentiating the various motives for and modes of investigation exhibited by chemical analysis, and the understandings it produced. It examines particularly the complex of sites and skills which connected factories, fixatives and dyes with analytical technique, and on the competitive intensification in the international alum market which focused and shaped this analytical attention.

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**Amphibian a priori: Filters, Fields, and the Contested Vision of Neuroscience**

Michael McGovern

*Princeton University*

What makes one research program croak, and another purr? Touted as the origin point of second-order cybernetics, the 1959 paper “What the Frog’s Eye Tells the Frog’s Brain” emerged from attempts by MIT’s Warren McCulloch, Jerome Lettvin, and others to apply cybernetic logic to living brains. It claimed that fibers in the frog optic nerve were coded to relay distinct signals to the brain, each having one of a variety of “filters” tailored to the survival needs of the frog. This interpretation was as controversial as the experiment underlying it was capricious; only Lettvin’s sensitive hand could reproduce results, and the group largely abandoned the research. At the same time, David Hubel and Torsten Wiesel relocated from Johns Hopkins across the river to Harvard Medical School. Using a similar setup for the cat, they had just published a paper showing direction-specific “receptive fields” in single neurons of the cortex. This became the basis for studies of binocular vision that won them the 1981 Nobel Prize for Physiology or Medicine. Through close reading of the published literature and engagement with oral histories and material from McCulloch’s archive, I argue that although they diverged substantially, these research programs were seen as complementary, particularly in early artificial intelligence research. While the cybernetics group invoked images of mental hardwiring, the Harvard team appealed to higher-order cognition. Such disciplinary distinctions, I suggest, reflect contests within the brain sciences over the character of liberal subjectivity in Cold War America.
An Arctic Case Study: Humanism in Real Time

Donna Bilak
Columbia University

This paper addresses questions about the current shape of the humanities raised through two experimental jewelry arts workshops held at a vocational school in the Canadian Arctic. These workshops investigated the idea of an artisanal epistemology in early modern enquiries into the natural world in relation to contemporary modes of indigenous knowledge production. In the Inuit cultural context, the acquisition and dissemination of knowledge is not rooted in textual traditions, but bodily embedded in oral histories, craft technology, and land stewardship. Through this lens of indigenous interaction with Renaissance scholarship, this paper reflects on the utility of reconstruction and material literacy as present-day history of science methodologies, in which scholarly textual interpretation meets physical research, as well as the nature of cultural heritage in shaping material practice. This cross-cultural knowledge exchange also engenders a wider reflection about the turn within the humanities to increasingly greater emphasis on interdisciplinary research and multidisciplinary collaborations, in which breaking down disciplinary siloes poses big challenges. How do our actions and values as scholars shape the intellectual heritage that we are creating right now, in our own historical moment? How might new collaborative practices between humanists, artisans, and scientists reorient this? Who is knowledge for, anyway?


Abeer Saha
University of Virginia

Concentrated Animal Feeding Operations, or feedlots, are sites in which animal bodies are produced through the systematic application of scientific knowledge, state regulations, and the logic of capitalism. It is where cattle are “finished” on genetically-modified grains laced with hormones and antibiotics, for a four-to-six month period, before being sent to slaughter. By concentrating and systematizing the large-scale feeding of grains to livestock, feedlots have allowed the cattle population to escape the ecological limitations of a grass-based diet and hence allowed their impact on global warming, as well as ground water pollution and exhaustion, to go unchecked. While shortening the average lifespan of the American cow, feedlots have led to greater efficiencies and concentration in beef production. This is not a by-product of the unfettered free market, but instead results from federal price-supports for corn, extensive water rights, and state-funded research at land-grant colleges. It was in the state universities of Iowa, Kansas, Nebraska, and Colorado, and their ag-stations that antibiotics and explanation of suffering and evil rooted in natural laws, both to defend science against its critics and to reconcile belief in natural law with their religious faith. The second paper shows how Macmillan’s Magazine and several other Victorian periodicals provided an outlet for Darwinians who sought to establish themselves as respectable, cultural authorities. Although they challenged the conventions of polite debate about science and religion, they also rejected or avoided the idea that science and religion were in conflict. The final paper argues that an uncritical acceptance of Andrew Dickson White’s conflict thesis led some leading American Protestant scientists and theologians to abandon traditional Christian theology and to embrace theological “modernism.”

Anglo-American Science and Liberal Religion, 1840-1940

Edward Davis
Messiah College

The papers in this session examine some of the attitudes and beliefs that various religious liberals held in conversation with science in England and America, from the mid-nineteenth century to the mid-twentieth century. The first paper demonstrates that American Unitarians used “natural law theodicy,” an
synthetic hormones were first tested and developed for application in feedlots. Land-grant colleges were thus central to mid-twentieth century developments in animal agriculture and their research paved the way for present-day factory farming. By studying the ways in which agricultural experiment stations at land-grant colleges shaped the relationship between creatures, capitalists, and the state, this paper will illustrate the public-private nature of American capitalism and American agriculture.


Daniel Cardoso Llach  
*Carnegie Mellon University*

As it transited from tech to university in the late 1960s, Carnegie Mellon started the School of Urban and Public Affairs (SUPA) with the ambition to “deal in a scientific manner with problems of the public sector” and help build the “civil-industrial complex.” Funded by gifts from the Richard King Mellon Trusts and the Aluminum Co. of America, the new school sought the confluence of disciplines such as political science, anthropology, sociology, and urban planning into issues of public administration and –crucially– urban renewal. Aligned with its interdisciplinary mission, the school organized three institutes in cooperation with other Schools: The Institute of Physical Planning, with Architecture; the Urban Systems Institute, with Industrial Administration; and the Joint Urban Science Information Institute, with University of Pittsburgh’s Public and International Affairs. In this paper I draw from archival materials, interviews, and historical software reconstructions to offer a detailed picture of the intersection of architectural and scientific sensibilities at SUPA with a special focus on the work by faculty and students at the Institute for Physical Planning between 1969 and 1974. Examining it as an illustration of the broader intellectual realignment of architecture in the postwar, and drawing methodological insight from recent experimental reconstructions and media archaeologies, I will show the IPP as one site where a self-consciously scientific architectural discourse emerged in the United States; discuss its technical and institutional supports; and document the role it played in articulating new architectural identities and imaginaries, shedding light on their generative contradictions and ongoing legacies.

**Art Histories around 1900**

Maria Teresa Costa  
*Max Planck Institute for the History of Science, Berlin*

Between the end of the 19th and the beginning of the 20th century art history arises as a scientific discipline, taking part in the process of systematization of the human sciences in their relationship to the natural sciences. From the perspective of the history of science this period can be seen as the most productive for art history, as it is confronted with a fundamental rethinking of its tools, aims and methodologies. Kunstwissenschaft (‘science of art’) emerges at that time as a counterpart to the well-established connoisseurship. If the latter looks at the work of art in its singularity, studying its material and technical aspects, with an attributionist aim, Kunstwissenschaft deals with analyzing the work of art within its broader cultural context, in reconstructing its social, cultural and political dimensions, and in the dialogue with other disciplines. Both groups of art historians want to legitimate their methodologies on a “scientific” basis, the former grounded in the direct observation of the work of art, the latter developing a series of general concepts (Grundbegriffe) and formal laws, which should be valid for interpreting works coming from different cultural contexts. This paper aims to discuss the methodological gap between different approaches to art history in the epoch in which there was a more intensive aim to build its disciplinary identity, and to follow its development in the actual art historical practices.

**Art-Science: Premodern Theory and Practice Entangled**

Adam Fix  
*University of Minnesota*
In recent years, historians of both science and the arts have recognized the vital role of craft knowledge and artisanal practice in the development of the premodern sciences. Nevertheless, unraveling the complex relationships between speculative/intellectual and practical/artisanal traditions in the premodern world has often proven to be a maddening task. This panel begins with the conviction that these domains cannot—and indeed should not—be neatly divided, and embraces their nebulous and permeable boundaries not as an obstacle but a promising opportunity. Hence, we focus on “art-science”: theory-laden crafts and handiwork, or craft-like sciences and philosophy, that have fallen through the cracks of conventional historiographical categories. This encompasses such topics as instrumentalized modes of representation and models of human vision, the cross-cultural exchange of Renaissance artisanal epistemology, and the mathematical-experimental science of musical composition. Though we center on Western European sciences in the late-sixteenth and seventeenth centuries, we consider the broader implications of art-science as a form of knowledge that crosses and blurs disciplinary and cultural boundaries, inviting new possibilities for teaching and experiencing the history of science. Through these studies, this panel will circumvent anachronistic dichotomies between science and craft, challenge conceptual barriers within the history of science as a discipline, and demonstrate how the knowledge and practices of artisans were embedded in the sciences of the premodern world.

**Artisans and Artificial Hands: Reading Early Modern Objects Inside and Out**

Heidi Hausse
Auburn University

Prosthetic hands in early modern Europe were singular objects of artifice designed to supplement the natural body. With moveable fingers and flesh-toned paint, they incorporated practical and aesthetic functions in ways impossible for other kinds of prostheses. After all, silver noses could not smell, nor enameled eyeballs see. Iron hands, by contrast, could hold other objects. Made of metal, wood, leather, and paint, these artifacts have sparked modern imaginations since the nineteenth century, when pseudo-historical accounts arose attempting to identify the original wearers of surviving examples, often describing them as possessions of injured knights. The presentation of these objects in museums and print today predominantly reflects this tradition.

This paper argues that rather than these objects’ wearers, we should investigate their makers. The vast majority of early modern prosthetic hands have unknown provenances: they cannot be linked directly to specific historical persons. But they can be linked to craft practices, and through these practices tied to groups of people. Reading extant artifacts—extracting information by studying their material components—is crucial for finding clues to the world in which they were produced. Using several German artifacts from the sixteenth and seventeenth centuries, this paper reads prosthetic hands to explore how these objects were made and what functions they served in early modern society. It proposes that incorporating 3D modeling of these objects along with firsthand observation has the potential to reveal much about early modern intersections of medicine, technology, and culture.

**As if They were Ministers of God: Religion and Epidemic Control in Nineteenth-Century Mexico**

Farren Yero
Duke University

On a Sunday morning in 1805, Father Andrés Rosillo y Meruélo preached about a marvelous new discovery—a vaccine that promised to save his parishioners and their families from disease. The priest proclaimed in his sermon that day that Christ’s sacrifice on the cross not only enabled man’s eternal salvation but also freed him from the scourge of smallpox. Redemption from this plague came in the form of a vaccine, discovered just a few years before, and transported to the Spanish Americas in 1804. But this gift came with strings attached. Rosillo insisted
that the vaccine be received fearfully and willingly, as a reminder to Church acolytes of their duties to God. Indeed, as a divine gift, remitted by King Carlos IV, vaccination was ostensibly both free and voluntary, requiring the consent of patients or parents throughout the Spanish Empire. In a moment increasingly identified by secularization and professionalization of medical science, this paper addresses the central role of parish priests in navigating the question of medical consent. Drawn from sermons, medical records, and colonial correspondence, I analyze an episode of epidemic outbreak and vaccine use to address key questions about the work of religion in Mexico at the intersection of state intervention, medical practice, and patient care.

Asia and the Global Origins of the Social Sciences, 1700-1900

Mårten Söderblom Saarela
Max Planck Institute for the History of Science, Berlin

This panel aims to consider the contributions of Asian traditions of scholarship to the formation of modern disciplines commonly seen as Western in origin. During the eighteenth and nineteenth centuries, academic disciplines now grouped as the humanities and social sciences took shape in new university departments, academic journals, and other institutions that continue to structure scholarship today. It has often seemed that these epistemic formations spread through European imperialism to be adapted and transformed in Asia, displacing existing knowledge traditions. Yet as new histories have begun to suggest, our modern disciplines were not the singular invention of Europe, but co-produced globally. How, then, were Asian knowledge traditions deployed in the global construction of fields such as linguistics, philosophy, and comparative law? In the eighteenth century, Jesuit engagement with Indian pandits created foundational axioms of anthropology. At the turn of the nineteenth century, Qing linguistic scholarship was deployed in phonetic descriptions of Chinese for Western students, as disagreements over Daoism cemented the separation of philosophy from orientalism. By the era of high imperialism, Japanese legal experts mobilized their traditional philology to contribute to the idea of diffusionism itself. Through the circulation of books, artefacts, and practices as well as encounters and exchanges with Asian scholars, new modes of knowledge production emerged in the West from diverse beginnings. Modern disciplines in the humanities and social sciences should be seen as truly global, not just in their geographical reach, but also in their intellectual origins.

Assaults on the Body of the Sovereign: Poison, Alchemy, and Magic in Sixteenth-century Germany

Tara Nummedal
Brown University

In early modern Europe, many princes saw enormous value in supporting natural knowledge at court, regularly supporting experts who could extend the power of the state over nature and sustain the health of the sovereign. In the mid-sixteenth century, however, a disturbing cluster of incidents at several courts in the Holy Roman Empire suggested that expertise with nature was as likely to destabilize princely rule as it was to bolster it. In Gotha, an imperial knight named Grumbach was said to have used a potion in the 1560s to bewitch his patron, convincing him that angels wanted him to mount a military campaign against the Holy Roman Emperor. In Berlin, the elector died unexpectedly in 1571 when his (Jewish) Master of the Mint Lippold supposedly gave him poison-laced wine, while in 1575, at the ducal court in Wolfenbüttel, the alchemist Anna Zieglerin reportedly attempted to poison the duchess and to win the duke’s favors with love magic. Although each of these shocking assaults was an isolated event, observers saw a through-line: treacherous courtiers deploying magic, poison, and alchemy to manipulate the affections of—if not kill—their patrons. In this paper, I will examine the implications of these terrifying instances of patronage gone awry for the practice of alchemy in central
Europe, arguing that they highlighted the fragility of princely rule and reframed the court alchemist’s knowledge of nature as a potential threat, not a boon, to the body of the sovereign and the early modern state.

**Attempting Neutrality: IUPAC, IUPAP, and the Resolution of a Cold War Scientific Controversy**

Ann Robinson
Independent scholar

Beginning in the 1950s, two laboratories—one in the United States and one in the Soviet Union—engaged in the synthesis of elements with an atomic number greater than 100 (a third laboratory, in West Germany, began production in the 1980s). Each relied on different methods for synthesis and detection of atoms of these elements which resulted in competing discovery claims, and sometimes competing element names. These controversies were often acrimonious and occasionally spilled over into the general scientific community. Both sides appealed to the International Union of Pure and Applied Chemistry (IUPAC), the body with control over the naming of new elements, to settle the matter. In the 1970s, the IUPAC approached the International Union of Pure and Applied Physics (IUPAP) about forming a so-called joint neutral group to study the problem and suggest a solution. This group was far from neutral and failed to even meet, much less come up with a solution. In the 1980s, the IUPAP decided to take matters into their own hands and create a new group with the IUPAC to end discovery controversies. The IUPAP was very aware of the need “to avoid even the appearance of conflict of interest,” and attempted to form as neutral a group as possible. This paper will therefore explore processes, practices and protagonists of scientific publishing from the sixteenth to the nineteenth century in various disciplines. Topics to be addressed include: modes of authorship, practices of editing, the use of paper technologies, and cultures of scientific publishing.

**Automata and Artifice**

Jessica Keating
Carleton College

This paper examines human and animal bodies that were painstakingly assembled and programmed by clockmakers during the sixteenth and seventeenth centuries in the German-speaking world. Known today as automata, these self-propelled mechanical objects have long been seen by scholars as exemplary of the early modern desire to replicate nature. But why, this paper asks, is this the case when all the extant examples of automata look unquestionably un-lifelike? Nothing about them—not their scale, their material makeup, their subject matter, nor their programmed movement—is naturalistic. In taking seriously what early modern automata replicate, this paper proposes a new mode for thinking of early modern mechanical bodies that sees them at odds with lived experience and not continuous with it.
Bateson on Characters, Genes, and Species as Theoretical Elements

Aleta Quinn
University of Idaho; Smithsonian Institution

I argue that William Bateson’s analogies between the units of genetics and chemical elements are best understood as analogies to theoretical entities in the history and practice of chemistry. Bateson did not intend that the units of heredity answer to material units that behave in ways analogous to material atoms. His point was that biologists of his day should postulate a theoretical entity, basic to the science as elements once were to chemistry. Bateson matter-of-factly asserted that species fixity was first established as a scientific hypothesis in the eighteenth century and took this hypothesis to be an important scientific advance. Bateson’s readers would neither have been surprised at, nor skeptical of, these claims. I demonstrate via history of biology texts written in the early twentieth century that straightforwardly report that Linnaeus’ two most important contributions to biology were binomial nomenclature and the concept of fixed species. Chemical elements were reinterpreted during Bateson’s lifetime and replaced by electrons, neutrons, and protons as basic units, recognizing that elements can in fact transmute. Comparing characters, genes, and species to chemical elements predicted that scientific progress would be made by positing theoretical entities that would later be revised within a new theoretical framework.

Between Dissonance and Nuisance: The Understandings of Noise before the Mechanical Reproduction of Sound

Chen-Pang Yeang
University of Toronto

Noise has been a common sonic experience since the beginning of history. For a long time, noise was construed as sound of any form, aggregate of sounds, voice, cry, or roar that was voluminous, disturbing, composite, or extraordinary. By the nineteenth century, however, two specific understandings emerged from this generic characterization: noise as irregular and inharmonious sounds that went against the human senses, and noise as annoying sounds of the surrounding that invaded into the public and private spaces and disrupted tranquility. While the idea of noise as discordance and the idea of noise as nuisance intertwined with each other, they came from different historical contexts. The concept of discordance tied to the Western theories of music since Antiquity, especially their preoccupation with harmonious tones and attempts to make sense of such tones with cosmic-numerological or (later on) psycho-physiological reasons. The concept of nuisance had a close relationship with the efforts by governments, local communities, and civic groups to control and “abate” din in urban and industrial settings. Owing to the rise of acoustical and psycho-physiological research on sounds and the increasing severity of clamor as a consequence of urbanization and the Industrial Revolution, these two notions became the dominant subjects of discussions on noise in technical literature and public discourses before the introduction of the sound-reproducing technologies. These two understandings of noise also became the invisible yet important backgrounds when scientists and engineers in the twentieth century dealt with acoustic and informational noise.

Between East and West: Technology Transfer, Industrial Production, and Cold War Diplomacy in Socialist China, 1945-1980

Zhaojin Zeng
University of Pittsburgh

Situated at the intersection between the history of technology, economic history, and diplomatic history, this paper examines China’s three major waves of technology transfer during the Cold War period: from the Soviet in the 1950s, from Western European countries, the United States, and Japan in the early 1960s and 1970s, and from an even larger group of Western and Eastern countries in the late 1970s and
1980s. Drawing on heretofore unavailable ground-level factory archives and government documents, this paper looks at how Maoist China alternated between the Eastern and Western Blocs to import advanced industrial technology. In particular, it explores how technology transfer, as a result of geopolitical changes, affected industrial production on the ground level and how factory workers responded to technology from different foreign countries. Theoretically, this paper tends to see technology transfer as political and institutional processes in the local society. Foreign technology was received not only as technology itself; also, it came along with a series of political campaigns and institutional changes by the communist state intended to reinforce their control over factories and workers. For the vast number of local industrial factories, technology transfer turned out to be more about political campaigns and institutional changes than about technological change. Using the case of Cold War China, this paper highlights the role of technology as a contested force that interacted with geopolitics and Maoism to transform the institutions and practice of China’s industrial economy and society in the second half of the twentieth century.

**Between Standardization and Medical Ethics: The History of Health-related Quality of Life Measures**

Leah McClimans  
*University College Cork; University of South Carolina*

Since the 1970’s epidemiological measures focusing on “health-related quality of life” have figured increasingly as endpoints in clinical trials. Before the 1970’s these measures were known, generically, as functional measures or health status measures. Relabeled as “quality of life measures” they were first used in cancer trials. They were relabeled again in the early 2000’s as “patient-reported outcome measures” or PROMs, in their service to the FDA to support drug labeling claims. Despite their importance in medicine over the past seventy years, remarkably little historical research has been done on them. This is problematic. First, lacking a historical account, the quality of life literature itself fails to recognize how certain themes have developed, themes that should inform current practice. Second, adjunct literatures, such as philosophy, misappropriate these instruments in terms of quality of life measures originating in economics and development—measures that are more familiar to philosophical analysis. I begin by discussing their history by linking their contemporary significance to two post-WWII trends: standardization of medical decisions and the
autonomy model in medical ethics. I will show how these instruments set themselves apart from other categories of quality of life measurement by their commitment to “capturing patients’ perspectives”. This commitment, evident in high impact journals, policy bodies and funding agencies, creates an interesting tension regarding what it means to be a “measure”. I conclude that this emphasis on patient perspectives affects the ability of researchers to settle epistemic and methodological questions.

Beyond Psychogenic Versus Biogenic: Rereading the History of Psychiatry

Justin Garson
Hunter College

Standard histories of psychiatry rely heavily on the distinction between psychogenic and biogenic approaches to mental illness. This distinction provides a framework for grouping actors into larger configurations, tracing the tensions between those configurations, and explaining psychiatry’s major transitions. For example, the “medicalization” of American psychiatry in the 1970s is often described as a transition from a psychogenic to a biogenic paradigm; the traitement moral of early nineteenth-century France, a transition from a biogenic to a psychogenic one. I propose an alternative framework, which reads the history of psychiatry in terms of a clash between two paradigms, madness-as-strategy and madness-as-dysfunction. Proponents of the first paradigm, madness-as-strategy, view psychiatric problems as strategies that the person or organism is deploying to achieve some (perhaps unconscious) end. The researcher’s goal is to identify the purpose of the patient’s symptoms, and to use that knowledge to inform treatment. Proponents of the second paradigm, madness-as-dysfunction, view psychiatric problems in terms of the breakdown or dysfunction of the mind or brain. The researcher’s goal is to locate that dysfunction and fix it. The dysfunction/strategy distinction crosscuts the biogenic/psychogenic one in interesting ways. One benefit of this framework is that it creates new configurations of actors and it provides alternative descriptions of major transitions. For example, the “medicalization” of American psychiatry can be seen as a transition from a madness-as-strategy paradigm to a madness-as-dysfunction paradigm, and the evolutionary psychology of today can be shown to have stronger liaisons with psychoanalysis than with neuropsychopharmacology.

Biased Descriptions of Ant Colony Behavior: How the History of Terms is Affecting Current Research

Ryan Ketcham
Indiana University - Bloomington

In 2016 Deborah Gordon proposed that the term ‘division of labor’ was misleading and ought to be abandoned. The problem with the term, as she saw it, was that it implied a division of labor among specialized castes of workers to explain colony behavior. In a series of experiments in the 1980s, Gordon discovered that observed colony behavior could not be caused by such a division. Gordon proposed ‘task allocation’ as an alternative description that allowed for a broader range of possible explanations, including inter-individual interaction in dynamic networks. These interactions can happen on short time scales, and Robert Jeanne took Gordon’s ‘task allocation’ to mean just those brief interactions. Jeanne has fiercely rejected Gordon’s proposal on the mistaken grounds that she has called for abandoning developmental explanations, and that her account of division of labor distorts the productive history of the term as researchers have used it. In fact, the term has been used to mean a great many things since Oster and Wilson associated it with optimality modeling and sociobiology in 1979. The reasoning in this controversy can be clarified with a framework Elisabeth Lloyd has called “The Logic of Research Questions.” This framework involves identifying what answers are possible and responsive to a given research question, and can be used to distinguish what restrictions the terms ‘division of labor’ and ‘task allocation’ imply. With this framework I will disentangle historical uses of the term, show how
Gordon’s proposal has continued to be mischaracterized.

**Big Data and Close Reading: Newton’s Life and Work Between the Inner Mind and the Outer Limits**

Rob Iliffe  
*Oxford University*

In this talk I assess how the availability of Newton’s writings in a searchable, digital format has transformed our capacity to understand and explain his intellectual work. I examine the ways in which the existence of various datasets has allowed modern researchers both to examine Newton’s work in unprecedented detail, and also to investigate how his methods and conceptual apparatus in one of his subject-areas (in this case, his theological work) shared similar approaches to those he adopted in other subjects. Indeed, it is now possible to see much more clearly than before how his research in areas such as theology, alchemy and natural philosophy cohered (or did not). However, I conclude that in order to do innovative but robust scholarly research of this kind, one needs experience in the use of such digital resources, along with the full toolbox of traditional scholarly skills. One needs also to be aware of the extent to which the Newton that emerges from this new research is shaped, or even determined by these new methods of historical investigation.

**Biology and Nationalism in Modern Korea and China**

Christine Luk  
*University of Hong Kong*

Historians of science have long been interested in the relationship between the making of scientific knowledge and emerging forms of nationalistic thinking. This panel gives a comparative examination of the intertwining of biology and nationalism in twentieth-century Korea and China. Consisting of early-career scholars working on issues of how nationalism informs biologists’ approaches to knowledge-making in colonial Korea and Republican China, this panel aims to shed light on some of the core themes underlying the two modern East Asian states’ encounters with biology and nationalism. Wendy Fu will examine the national, scientific, and commercial significance of the soybean as a vital technology in relation to the changing industrial and agricultural contexts in Republican China. Christine Luk will assess the emergence of marine biology as a critical factor for national salvation in Republican China, highlighting the centrality of the ocean for biological study and nation-building. Manyong Moon will explore the legacy of Japanese colonialism on experimental biology since its beginnings, differed, among other things, in the consideration of these principles. This paper presents the properties and epistemological basis of pertinent models, from Mendel’s model of heredity in the 19th century to Eric Davidson’s model of developmental gene regulatory networks in the 21st, and analyzes the extent to which the above principles explicitly or implicitly guided the modelling process. It claims that models that disregarded these principles, such as D’Arcy Thompson’s models of biological form, failed to impact the direction of biological research in a lasting way, and that purely mathematical descriptions or simulations of biological phenomena, without incorporating a mechanistic idea and without experimental testing, fail to illuminate the biological causality.

**Biological Specificity, Genetic Causation, and Mathematical Modelling in the History of Modern Biology**

Ute Deichmann  
*Ben-Gurion University of the Negev*

The concepts of biological specificity (of species, macromolecules, genes etc.) and genetic causality (in particular regarding heredity and development) played an important role in rendering biology a modern experimental science in the nineteenth century. Neglecting these concepts often led to stagnation in a field of study as, for example, in Spemann’s embryology, which excluded genetic causality. Mathematical models, which were widespread in
three Korean biologists’ career patterns and research activities. Tae-Ho Kim will consider the demise of barley cultivation in the contexts of colonial and postcolonial South Korea. From marine biology to food science, this panel brings together some of the latest research in the history of biology in modern East Asia, emphasizing the value of cross-regional comparison.

**Birth and Death in the Maternity Ward of the Guadalajara’s Hospital Civil, 1870-1940**

Laura Shelton  
*Franklin and Marshall College*

This essay examines the maternity ward records in the city of Guadalajara, Mexico in order to understand the hospital as a space where mothers, doctors, and midwives encountered one another and the State, and where they sought to legitimize and define the field of medicine at a time when childbirth practices were contested and in flux. In spite of their different views of the body and healing, they also created medical treatments and new habits from these gendered and multiethnic encounters. The hospital became an important site for these groups to legitimate their work, craft their identities, and contest the work of their rivals. This essay makes a case for both understanding the hospital as a site for the production of a profession and as a place where the boundaries between “folk medicine” and professional medicine and between “local” and “universal” medical knowledge were interwoven.

**Bodies of Formalization**

Stephanie Dick  
*University of Pennsylvania*

This panel explores intersections between human bodies and formal systems in the twentieth-century. The panel cuts across the history of forensics, mathematics, computing, and dance in order to demonstrate how different communities have worked to erase bodies, represent bodies, control bodies, identify bodies, and classify bodies through formalization. We recover and reconstruct the technologies, practices, aesthetics, and politics that inform twentieth-century formalisms, so often touted as neutral abstractions. Kelly Gates’ paper explores Alphonse Bertillon’s crime-scene photographs, their place in his forensic classification project and their recent resurgence as a subject of museum exhibition, emphasizing the historical significance of police uses of photography. Clare Kim demonstrates how formal axiomatic methods developed in early twentieth-century mathematics were used to erase racial and cultural difference among mathematicians, especially within American efforts to appropriate Chinese and Japanese mathematics. Stephanie Dick explores early efforts to formalize and automate facial recognition at the University of Texas at Austin, the problematic norms built into this software, and the competing standards of identification that surrounded its use. And Whitney Laemmli investigates an attempt to formalize movement and dance in the mid-twentieth century that had the effect of erasing the creative contributions of dancers themselves. Together, these papers explore how race, creativity, criminality, and identity have been encoded in formal systems, those hallmarks of modernity, through particular configurations of technology, practice, politics, and aesthetics.

**Body as Substance and Quantified Body in the Early Thirteenth Century**

Neil Lewis  
*Georgetown University*

This talk will explore the relation of the notion of body to the Aristotelian categorial scheme as expressed in the distinction between body as substance (corpus substantia) and quantified body (corpus quantum) employed by thirteenth and fourteen-century thinkers. The focus will be on the early thirteenth-century thinker Robert Grosseteste, an important figure in the history of science and the first in the Latin West to write a commentary on Aristotle’s Physics, where this distinction makes one of its earliest appearances.
Over the last several years, scholars have increasingly attended to the role of craft knowledge and artisanal practices in early modern Europe. These studies have investigated the importance of hands-on experience for ways of knowing about the world and pointed to the significance of artisanal practices in the so-called Scientific Revolution. This panel uses the lens of hands-on practices to explore the processes and materials used to build different kinds of early modern bodies. The bodies we are concerned with are human and animal, natural and artificial, or some combination thereof. Noria Litaker’s paper, "Some Assembly Required," examines how local nuns, doctors, and artisans built seemingly intact saintly bodies from relic/bone fragments acquired from the Roman catacombs. Heidi Hausse’s paper, "Artisans and Artificial Hands," explores the material world of extant artifacts of prostheses to link them to craft practices. Jessica Keating’s paper, "Automata and Artifice," turns to clockwork automata and questions just how lifelike these objects appear under close scrutiny. Together, our papers ask how and why these different kinds of fabricated bodies took the forms they did. By bringing into conversation holy bodies, prosthetic parts of natural bodies, and entirely artificial and artful bodies, the panel aims to generate a fruitful dialogue about the nature of bodies as early moderns conceived them, the blurring lines between the natural and artificial in their creation, and the potential connections or divergences to be found in our different stories of making and materiality.

Boosters and Speculators of Southern California: Making Mount Wilson Observatory

Eun-Joo Ahn
University of California Santa Barbara

Southern California is the land of sunshine, outdoor adventures, and opportunities. It is the place of movies, aerospace industry, and a bastion of scientific research activities. These images are the result of active promotion by the region’s boosters for the past 150 years, as Southern California lacked natural resources with only the climate to boast of. With incoming railroads in the 1880s, Southern California developed via rampant land speculation and boosterism of all sorts that ranged from orange cultivation to wholesome living to tourism. Astrophysicist and science statesman George Ellery Hale was one of these successful boosters of Southern California. Arriving in 1903, he founded the Mount Wilson Observatory (MWO) in 1904 with grants from the Carnegie Institution of Washington. MWO soon became one of the world’s leading astronomical observatories. The Observatory was put into brochures advertising the region along with its hotels, gardens, and churches, as well as becoming a tourist attraction.

I propose that Hale was a speculator both in the financial and scientific sense. Hale succeeded in founding and developing MWO into a leading research institution because he chose the right place at the right time. Hale was able to court patrons both nationally and locally and to attract good scientists because of the ongoing promotion of Southern California had generated enthusiastic expectation that the region will grow in size and importance. MWO can be regarded as the starting point that put scientific research as one of the faces of Southern California.

Breaking the Toxic Mold: Mycotoxins and Interdisciplinary Research in the Postcolonial World

Lucas Mueller
Massachusetts Institute of Technology (MIT)

In 1960, veterinarians discovered an unknown toxic substance in poultry feed to have caused the death of hundreds of thousands of British turkeys. Veterinarians collaborated with nutrition scientists, chemists, toxicologists, and mycologists to identify what became known as aflatoxin, a carcinogenic poison produced by Aspergillus molds. Soon,
researchers in India, Africa, and elsewhere reported finding aflatoxin and other mycotoxins in peanuts, corn, and other crops. Many of them were important foodstuff, fodder, and export commodities for the new postcolonial nations. As aflatoxin became a global problem, because it arose in many different areas and affected major internationally traded commodities, the substance also emerged as a scientific object that would drive interdisciplinary and transnational collaborations for the next sixty years. The researchers investigated aflatoxin’s effects on human and animal health as well as which relations of crop, mold, environment, and humans’ agricultural practices resulted in the formation of mycotoxins. This paper argues that multispecies relations, Cold War and postcolonial geopolitics, and global trade influenced which regions and disciplines were involved in the collaborations that shaped the knowledge about aflatoxin. Focusing on the 1960s, this paper shows how concerns over the production and supply of animal- and plant-based protein-rich food to populations in postwar Great Britain and the newly independent nations in Asia and Africa shaped scientists’ interdisciplinary collaborations across Great Britain, India, and the United States.

Brevity is the Soul of Logic

David Dunning
Princeton University

Logic became a mathematical science in the decades around 1900; that same period saw a wild proliferation of systems for representing the newly mathematical logic on paper. The fertile period for notational invention that began with English mathematician George Boole’s algebraic methods in the mid nineteenth century reached a kind of apogee in interwar Poland, where logicians of the Lwów-Warsaw School effectively dissolved the line between notation and its object. Jan Łukasiewicz (1878-1956), one of the school’s leading figures, introduced a system of notation without punctuation or spacing. Every logical statement was represented by a single uninterrupted string of capital and lowercase Latin and Greek letters. Shorn of parentheses and other such outward flourishes, a statement’s length became a visually prominent and conceptually interesting attribute. Soon Łukasiewicz and his colleagues began working to build logical systems in as few letters as possible, seeing notational economy not merely as a stylistic virtue but as an object of scientific inquiry in itself. Their pursuit of brevity illustrates how a form of writing can shape and even reciprocally constitute the research programme that spawned it.

Building a Catholic Science: Scientific Strategies and Uses on the Italian Clerical Press in the Age of Positivism (1848-1914)

Carlo Bovolo
Independent Researcher

The paper deals with the attitudes toward, the uses and the receptions of the science on the Italian Catholic press in the second half of the 19th Century. In the course of the nineteenth century and particularly in the second half of the century, science started having a growing influence on Italy’s society and culture, hence threatening the authority and the influence of the Church and of Catholicism in Italy, which was in turn already under pressure because of the slow but gradual secularization. The centrality of science in the nineteenth century, moreover, put Catholics up against the question on how to react and face modernity, which had its strength in science and in the positive method, thus safeguarding the role of the Church and orthodoxy. Hence the spreading in some sectors of the catholic movement, especially in some clerical periodicals, of the need to build a science in accordance with Revelation, with the idea of developing strategies to embrace scientific matters through a Christian perspective, to respond to the lay and positivist materialistic theories of scientists, to strengthen a Catholic public opinion also in the sciences, and to strive for a scientific popularization harmonised with faith. The paper analyses how the science was faced and used by the Italian Catholic press, focusing in particular on three main topics: the evolution, the technological progress, and the
Especially when offering a new model or perspective, scientists share the creative writer’s task of using language to activate the imagination, of getting readers to see what they mean. To feel real, language aimed at the imagination must appeal to every sensory modality, much as the world acts on all senses at once. In collaboration with neuroscientists, literary scholars such as Elaine Scarry and G. Gabrielle Starr have begun studying the ways that finely crafted literary language can cue visual mental imagery, or combinations of visual, auditory, and motor imagery. This presentation will compare the ways that neuroscientist Santiago Ramón y Cajal and biologist James Watson appealed to their readers’ imaginations in their scientific and popular or fictional writing. The analysis will focus on Ramón y Cajal’s short story, "The Corrected Pessimist," in which a depressed scientist suddenly sees the world as though magnified 2000 times through a microscope; on Watson’s and Francis Crick’s The Double Helix; and on scientific articles and books by Ramón y Cajal, Watson, and Crick. Ramón y Cajal called his 1905 story collection Vacation Stories, hinting that for a scientist, writing fiction involves mental play. I will argue that for a scientist presenting a new way of seeing cells or molecules, fiction-writing can offer a valuable mental workout: the task of mustering language that will evoke in others what one inwardly senses to be true.

Calibrating Political Economies: August Boeckh and the Treasury

Anna Echterhölter
University of Vienna

August Boeckh (1785-1867) is still esteemed for a publication that appears to be a comprehensive handbook of all weights and measures of antiquity. In succinct numerical prose, he demonstrates the interrelatedness of all metrological systems of the Mediterranean world up to the sixth century. But there is not a single explicit word about the effects and functions of these ubiquitous units of measurement.

By a Hair’s Breadth: Measuring Hair in the Nineteenth Century

Timothy Minella
University of Kentucky

In the middle of the nineteenth century, lawyer and naturalist Peter A. Browne of Philadelphia obsessively collected, measured, and classified the hair of humans and animals. He built what he claimed to be the largest collection of hair specimens in the world. Browne had at least two major goals in this project. First, he wanted to understand sheep’s wool in order to improve the breeding of sheep in the United States. Second, Browne thought his studies of human hair would shed light on questions surrounding the origins of human beings. Browne argued that his measurements of the hair of different races—whites, blacks, and American Indians—proved that these races actually constituted separate species because of the characteristic differences between their hair. I will examine Browne’s various methods for measuring hair. He built instruments to measure the fineness, flexibility, and tenacity of his hair samples. By quantifying certain characteristics of his specimens of sheep’s wool, Browne attempted to show that the wool of American sheep was of the same or better quality than the leading European wools. Browne’s quantification of human hair contributed to his classification of the hair of black people as an exotic object that was quite different from, and inferior to, the hair of white people. Browne’s hair studies thus present a particularly interesting example of the quantifying and measuring spirit in nineteenth-century science.

Cajal and Watson Invoke the Senses as Creative Scientific Writers

Laura Otis
Emory University

Scientists and fiction-writers face the common challenge of awakening their readers’ senses.
The paper traces the manifest links of Boeckh’s rather factual compendium to political economy and state finance. These links exist on three levels: Boeckh firstly investigated metrology for his book on “The Public Economy of the Athenians.” Secondly, the very tradition he draws upon—the literature “de mensuris et ponderibus”—is easily contextualized within the financial sphere from Guillaume Budé, who wrote about measures and money alike, to Jean-Baptiste Louis de Romé de l’Isle, who dedicated his metrology to Jacques Necker. Thirdly there is Boeckh’s correspondence with his brother Christian Friedrich. The latter was to become finance minister of a stronghold of economic liberalism, the Grand Duchy of Baden. Furthermore, he was involved in the negotiations around the customs pound (“Zollpfund”), a metrological unit that anticipated the North German Confederation (“Norddeutscher Bund”). These implicit links to the treasury do not only connect the handbook to practical economic and legal questions. It will be argued that the very type of precision typical for this field is driven by monetary concerns and the measure of value.

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**Casting Cow Bones to Retrodict the Past: Nineteenth-Century Reconstructions of India’s Geological Past**

Emma Kitchen  
*University of Chicago*

In the nineteenth century, European savants sought to reconstruct the history of the earth. The character of the evidence was routinely faunal, utilizing ossified organisms. Such methods built upon Georges Cuvier’s concept of a natural hierarchy of animal functions, which designated specific anatomical parts as more effective in determining animal relatedness and identification. Often the highest in the hierarchy were the anatomical structures associated with life-giving processes, and not the more superfluous or external characteristics of an animal. Horns and hoofs were therefore low on the hierarchy. Despite this, naturalists continued to posit the connection between such external characteristics of extinct organisms and their surrounding environments. In Europe and India, naturalists tested the fidelity between external morphological structures of living animals and specific environments in the present, in order to apply those associations to the past, a practice not wholly dissimilar from the modern field of ecomorphology. In this paper I focus on such investigations into the fossil remains of a long-extinct animal—the ancestral taurine cow, or the aurochs. The aurochs featured prominently in attempts to set a global geological clock, and the horns and hoof bones of those extinct beasts aided European naturalists in reconstructing ancient environments, the age of the Himalayas, and bovine evolutionary history.

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**Chemical Practice and Compound Histories**

Lissa Roberts  
*University of Twente*

The problem of integrating chemistry into “grand narratives” or macro-scale studies of the past applies not only to the history of science but also to history more generally. How has chemistry figured in the history of politics, industry, education, or the environment, in the longue Durée? Chemistry identified as a series of abstract theories is unlikely to feature prominently in such accounts, but chemistry understood as rooted in practice, craft, productive activities and material culture offers a different picture. In this paper, taking a “sociomaterial” approach that highlights the integrated nature of social and cultural history with histories of chemical science, practice, and technology, we discuss two recent projects centered on chemistry and chemical practices rather than the mechanical sciences and mechanization as foundational elements of modern history. The first was an edited volume, Compound Histories: Materials, governance and production, 1760-1840. The second was a special issue of the journal History of Science (54 / 2016), entitled "Exploring global history through the lens of history of chemistry." Our contribution will focus on the interpretive consequences of a sociomaterial approach for understanding the history of domestic (o)economy in the eighteenth century, nineteenth-century...
industrialization and more recent discussions of 'commodity value chains'.

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**Chemistry and the “Big Picture” in the History of Science**

**Peter Ramberg**  
*Truman State University*

In an attempt to create a more coherent general picture of the history of science, historians have offered suggestions for categorizing the large-scale historical transformations in understanding nature, including "Ways of Knowing" (Pickstone) or "Styles of Knowing" (Kwa) and the use of mechanical metaphors like clocks and computers (van Lunteren). Other historians have advocated a generalist vision that moves away from microstudies to a "Grand Narrative." In many of these generalist histories of modern science, chemistry is relatively neglected, and this session brings together scholars to suggest ways in which the history of chemistry can enrich these larger narratives. Ramberg offers some speculations on possible reasons for the rarity of chemistry, and sketches out how history of chemistry would enrich the broader narratives in history of science. Gordin argues that fully incorporating chemistry into broader narratives is related to the difficulty in defining the boundaries of chemistry, connecting the historiographic problem to that of defining the political boundaries of Germany. Chang suggests that "compositionism" could serve as an effective modification of Pickstone's categories, and I would suggest we could further refine this to include "structuralism," a way of thought that has dominated chemistry for over a century. Applying each of these models to chemistry supports in turn a pluralistic view of chemical thought and practice, creating a "grand narrative" for chemistry itself.

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**Chemists in the Field and the Factory: Making and Knowing Outside the Laboratory, 1750-1850**

**Kristen Schranz**  
*University of Toronto*

In his First Part of a Dictionary of Chemistry (1789), the Scottish chemist James Keir claimed, ‘The progress of Chemistry within the last twenty years has been more rapid than...any science in an equal period.’ Around the mid-eighteenth century onwards, it is no surprise then to see the principles and practices of chemistry applied to ‘every object of human pursuits, political, commercial, and
philosophical.’ As recent historical studies have shown, analyzing and producing substances in the eighteenth and nineteenth centuries encompassed a variety of different sites and practitioners. This panel traces the ‘making and knowing’ that occurred outside of the brick-and-mortar educational and institutional chemical laboratories from 1750 to 1850. Intentionally engaging with current research in material culture, production and governance, and chemistry and the marketplace, these papers argue that fields, factories, and mines across Asia, Europe, and North America were vital spaces for chemical inquiry, material production, and commercial transformations. Government intervention in supporting the new chemistry varied according to region. Nevertheless, most chemists worked to gain respect for their novel methods of thought and practice that took them outside of the traditional laboratory–apparatus and skills were made portable for agricultural inquiry, chemical commodities were tested and improved in private manufactories, and new technologies of metal ore extraction were thoughtfully discussed and widely implemented. The chemistry of the field and factory was often constrained by local resources and knowledge, but it was also a subject informed by cosmopolitan networks of ideas and materials.

Chemists in the Field of Archaeology: Pigment Analysis of Paint Samples in Nineteenth-century England

Mariana Pinto
Utrecht University

During the nineteenth century, chemists were involved in conservation treatments of polychrome artworks. Appropriate methods for the cleaning of easel paintings, for instance, were sometimes done in consultation with chemists. In the field of archaeology, paint samples were extracted from historical objects and wall paintings with the aim to perform chemical analyses of pigments. This paper will show that the methodology and tools used by chemists for such analyses, agree with the standard chemical practices of the period. It also investigates the motivation behind the increasing engagement of chemists in the nineteenth-century field of archaeology. It has been argued that the main interest of chemists involved in the analysis of antiquities was not the preservation of objects, but the characterization of materials. In this paper it will be argued that, to the contrary, nineteenth-century primary sources reporting chemical analysis of pigments, show that chemists were also concerned about the physical integrity of historical and archaeological objects and their preservation. Such concern can be observed particularly in the extraction process of the paint samples used for chemical examination of pigments and binding media. The focus is on the nineteenth-century English context, since during this period the country held a leading position in the field of conservation practice.

Christian Gottlob Heyne, Friedrich August Wolf, and the ‘Science’ of Philology

Kristine Palmieri
University of Chicago

Friedrich August Wolf famously criticized the work of Christian Gottlob Heyne. Many subsequent scholars have accepted Wolf’s criticisms noting, among other things, that Heyne was uninterested in the kinds of rigorous textual criticism that would come to define philology’s nineteenth-century status as ‘queen’ of the sciences. This criticism has effectively removed Heyne from the history of philology, especially when it is conceptualized as a ‘modern’ discipline, though he remains a central figure in the histories of classics and archaeology. But Heyne was the philologist of note in Göttingen from his arrival in 1763 until his death in 1812, at which point Wolf’s own professional reputation had already begun to wane. Moreover, Heyne was at the center of an active and vibrant philological milieu, which he actively influenced in his capacity as Ordinary Professor of Poetry and Eloquence, director of the Philology Seminar, and head of the University Library. This paper thus argues that it is time for Heyne’s legacy as a philologist to be reassessed. In particular, it challenges conventional
accounts of Heyne’s deficiencies as a philologist by way of comparison with Wolf on three points: their ‘vision(s) of philology,’ their ‘philological toolkit(s),’ and their legacies as educators. This comparison demonstrates that accounts of Heyne’s reported antiquarianism have been overstated and argues that Heyne had a much larger role in the development of philology than is often acknowledged. It also questions what it means for philology to be more or less ‘scientific.’

Chymical Collections: Seventeenth-century Textual Transmutations in the Work of Arthur Dee

Megan Piorko
Georgia State University

In seventeenth-century Europe the practice of curating specific alchemical texts in order to create a comprehensive body of work increased rapidly owing to the technology of the printing press and the belief that these types of tract were most successful when used in tandem. Evidence of readership practices, scribal and print culture, and prefatory publication material all point to the active speculation of alchemical texts in a new and intentional manner during this century. The most widely collected and well known of this genre, Theatrum Chemicum, was printed in three editions from the years 1602 to 1661. This talk will examine material evidence of the speculative nature of this phenomenon. Chymical collections show fascinating examples of readers working through hermetically disguised alchemical concepts by drawing, annotating, cross referencing, and otherwise altering the pages of the texts. However, readers were not the only editors of these tracts. Authors, printers, and publishers also had agency in the way their alchemical collections were used. In the case of these texts, what is lacking was sometimes as intentional as what was printed. More broadly, chymical collections reflect cultural and intellectual issues brought on by the advent of print in the seventeenth century. The anxiety surrounding vernacularization, or vulgarization, of alchemical texts is illustrated by the relationship between English


Civilization and Diffusion: From Comparative Law to International Copyright

Hansun Hsiung
Max Planck Institute for the History of Science

In recent years, “diffusionism” has emerged as the most prominent bogeyman, if not straw man, for non-Eurocentric histories of science: witness proliferating critiques of Basalla, of Cold War development, of modernization theory. Such targets, however, should strike us as too easy. If we would now champion modernity as the “history of exchanges and entanglements...of the co-production of knowledge,” then we must also recognize that Eurocentric models of diffusion were not merely the construct of Euro-American labors, but actively promoted and elaborated upon by non-Western actors, for their own sensible reasons, based on their own beliefs about how knowledge moved.

This presentation outlines one portion of a more robust transnational genealogy of diffusionism. It does so by examining the rise of comparative law in Japan, and the role played by comparative legal scholars in shaping international copyright conventions premised on Eurocentric diffusionism. Arising out of philological efforts to understand Chinese rites (li), then growing though interchange with the nascent field of ethnology, Japanese comparative law developed a model of civilizational transfer that fused anthropological theory with prior concepts of Sinocentric acculturation. This model served as a key conceptual resource in Berlin, 1908, when Japanese comparative legal scholars were called upon to renegotiate the Berne Convention. Although first articulated in relation to China, Japanese scholars’ view that civilization consisted of a movement of knowledge from centers to peripheries encouraged
them to support a vision of international copyright whose goal was to diffuse ideas from Europe to “less-civilized” regions of the world.

Civilizing Medicine: Race, Gender, Sexuality, and Health in Theory and Practice on the Reservation

Courtney Thompson
Mississippi State University

The medical career of Mississippi native Andrew Bowles Holder (1860-1896) began inauspiciously. After receiving his medical degree, he obtained his first post thanks to his father’s letter to the Office of Indian Affairs, which resulted in Holder’s appointment as physician to the Crow Agency in Montana. Holder began his medical career far from home, facing a set of unusual healthcare challenges amongst a new, untrusting patient population. Holder confronted two challenges on the reservation. First, as an Agency physician, Holder faced outbreaks of pneumonia, diphtheria, malaria, dysentery, measles, and cholera, obstetrical cases, and the occasional gunshot wound. But Holder also experienced challenges to his ideas about normative behavior and bodies, particularly through his encounters with the Bote, individuals he described as “not men, not women,” and in his observations of indigenous health practices, which continued even in the face of the “civilizing” efforts of the Agency.

Holder’s manuscript and published writings on Native American health and bodies reflect four modes of knowledge production: ethnography, experiment, bibliography, and clinical observation. I use Holder’s career to explore the complexity of conceptions about embodiment at the end of the nineteenth century, and the extent to which first-hand experiences with non-white patients could reinforce or transform theoretical, philosophical, and political ideas about race, gender, sexuality, and health. In particular, I explore the extent to which medicine was perceived to be civilizing force, and the limits of this process in the face of intransigent native health practices and bodies.

Claiming Care: Medical Caregiving and Treaty Claims in the Western Great Lakes

Margaret Flood
University of Minnesota

Throughout much of the nineteenth-century in Ojibwe communities in the western Great Lakes of the United States, community members participated in a medically plural environment, seeking medical care from within their own communities as well as from French and Scots-Irish fur traders, New England Protestant missionaries, and federally-affiliated physicians at forts. Medical care circulated between settlers, traders, and Ojibwe communities, both instantiating social bonds and inflaming epistemic and religious differences.

This paper argues that while often overlooked in the historiography of nineteenth-century Native spaces in the Midwest, health and healing were central material concerns in these mixed colonial spaces, and as such health and healthiness became slippery frameworks for power relationships between Ojibwe community members, missionaries, traders, and Indian agents. Chronic and acute illnesses and injuries brought these diverse social groups into intimate contact and shaped their political, economic, and religious ventures. The entanglement of physical health with both material and cosmological consequence framed which practices and whose labor qualified as medical and whose body qualified as healthy. This paper draws from nineteenth-century economic claims on land-cession treaties from 1837 and 1855 to examine how various claimants, including white and mixed or married-in families, scripted medical care as superstitious, scientific, or social, operationalizing medical care as an economic and political good while simultaneously attesting to the social malleability of medical caregiving.

Clean Data on the Cholera Plague: Jaume Ferrán’s Submissions to the Prix Bréant

David Teira
UNED
From the 1850s onwards, the Parisian Academy of Sciences awarded the Prix Bréant to incentivize all sorts of contributions in the fight against cholera. We use the Bréant archive in order to reappraise an old debate within the History of Spanish medicine regarding the merits of Jaume Ferrán’s anti-cholera vaccine. In 1884, Ferrán, a Catalan physician, claimed to have synthesized in his laboratory a vaccine. It was then widely used in the Valencia 1885 epidemic. A self-proclaimed symbol of progressivism, Ferrán sought national and international recognition in order to develop his treatment. But he was caught in several political controversies that still loom large on the interpretation of his findings. Although Ferrán started applying for the Bréant as early as 1885, it was not awarded a mention until 1907. Spanish historians have interpreted the delay as a sign of a nationalist bias on the part of the French jury. Drawing on the archival materials of Ferrán’s submissions, we suggest a different interpretation in terms of the quality of the data that Ferrán presented. Although the physicians in the jury were not yet familiar with statistical inference, they were already demanding clarity and order in the presentation of data on clinical experiments, a requirement which Ferrán clearly failed to carry out, as we shall see. The jury’s demand for data cleanliness illustrates how a new standard of clinical data management emerged in medicine at the turn of the 20th century.

Climate and Time: The Shifting Status of 'The Janitor Geologist (FRS)'
Laura Brassington
University of Cambridge

In 1876, an unlikely candidate was considered for election to the Royal Society. Whilst his sunken eyes betrayed a lifetime spent in intellectual study, his body was crippled by years of working-class labour. The candidate was James Croll (1821-90). His qualifications for election were considerable: 92 articles in the Philosophical Magazine, Geological Magazine, and Chemical News, and four original monographs. Where Croll is remembered, it is as a geologist and climatologist, whose influential theories about ice ages caused Charles Darwin to revise Origin of Species (1869, 5th edn.). However, of Croll’s 17 proposers, half never met him in person. Whilst his contributions rewarded entry to the most prestigious scientific societies, the man himself remained a mystery. Croll was in fact born in poverty in rural Scotland. After learning to read from his elder brother, Croll became a fervent autodidact. By becoming a janitor at a college in Glasgow, he used the library to teach himself geology, metaphysics, and philosophy. In 1867, he was appointed to the Geological Survey and published a controversial but widely-read theory of climate change. Croll mediated seemingly antithetical worlds of emergent professional science, theology, and poverty through an extensive correspondence network. He exchanged 300 letters with gentlemen, churchmen, and ‘scientists’. In this paper, I argue that Croll used personae to be accepted as authoritative by men of different social, theological, and professional statuses, whilst also remaining true to his own convictions. By analysing correspondence, I consider multiple perspectives on status and theory in nineteenth-century science.

Climate Cartography from Maps to Models
Deborah Coen
Yale University

This session explores the history of attempts to visualize climate as a spatial phenomenon and the use of maps as historical records of climate change. The focus is on the early nineteenth to the mid twentieth century in central Europe, colonial Africa, and the United States, important contexts for the development of both mapmaking techniques and ecological frameworks of inquiry. Climate maps played key roles in the emerging disciplines of atmospheric physics, geology, geomorphology, ecology, evolutionary biology, and human biogeography. Simultaneously, they figured in debates for or against schemes of conquest, colonization, and development. Although they have drawn little attention from historians, maps of climate and related
phenomena merit analysis from multiple angles. As Mott Greene’s paper illustrates, they are rich sources for the history of climate science, revealing the instability of the very concept of climate. Climate maps are also unique windows onto the historical relationship between science and empire-building, as Deborah Coen’s and Philipp Lehmann’s papers suggest. A third approach, exemplified by David Spanagel’s paper, is to explore the uses to which such maps have been put. A single map can be read in quite different ways at different points in time, of which the present search for traces of anthropogenic climate change is just one in a long series of refractions. In sum, this session aims to draw attention to maps as sources for the history of climatology and allied sciences and to expand the range of historical questions that we bring to them.

Collecting the Archipelago: Georg Everhard Rumphius (1627-1702) and his Inter-Island Information Networks

Genie Yoo
Princeton University

How did a supposedly blind man living on one island collect natural-historical knowledge about an archipelago of tens of thousands? This paper discusses the inter-island information networks of Georg Everhard Rumphius (1627-1702) who, living on the island of Ambon from the age of 25 until his death, explored, experimented, and wrote about the natural world of the Indies while working for the United Dutch East India Company. While the titles of Rumphius’ best-known works prominently feature the adjectival form of the island he considered home—Het Amboinsch Kruydboek and D’Amboinsche Rariteitkamer—these works are rich in detail about other islands in the vast archipelago that straddled the maritime worlds of the Indian and Pacific Oceans. This paper discusses how Rumphius became a mediator of mediators by using a combination of his cross-cultural, administrative, and commercial networks stretching across the archipelago. By engaging with itinerant merchants, Muslim elites, royal emissaries, and slaves, Rumphius collected information about the natural and the supernatural world of the Indies and conveyed such information to others through selective storytelling, personal correspondence, and the gifting of plant samples from Ambon to the administrative center of Batavia. By highlighting Rumphius’ inter-island networks, this paper shows how the process of interpreting different kinds of local knowledge underwent its own complicated circuits of transmission within the archipelago before reaching its intended European audiences. Furthermore, this paper stresses the importance of inter-island correspondence for collecting and correcting natural-historical information that would ultimately be compiled in his monumental Het Amboinsch Kruydboek.

Collecting, Printing, and Publishing Natural History in the Long Eighteenth Century

Edwin Rose
University of Cambridge

This panel brings together material, global and bibliographical approaches to natural history during the long eighteenth century (c. 1680-1820), seeking parallels between the processes involved in transferring three dimensional objects into a publication. Concentrating on a selection of different historical actors and situating knowledge production in a variety of geographical and social settings, each paper in this session endeavours to unfold the dynamic connections between objects, publications and a range of different, and sometimes obscure, actors who contributed to the production and dissemination of natural-historical knowledge. While the first paper is concerned with approaches to collecting information in the field, concentrating on the information networks of Georg Everhard Rumphius in the East Indies, through which he gathered material for his publications, the second paper examines the work of the Berlin based Jewish Physician Marcus Â‰lizer Bloch, and how he converted fish specimens gathered from across the oceans into his Allgemeine Naturgeschichte der Fische (1782-1794). The next paper brings into account the
late-eighteenth century publishing practices of Joseph Banks, who produced a number of botanical books which he then distributed on a global scale. Paper four examines the cases of Thomas Molyneux and Hans Sloane and their use of fossil elephant's teeth to dismiss the popular belief that they originated from giants, following accounts they published in the Philosophical Transactions. The final paper examines the connections between scientific oceanic exploration, examining the use of images by Count Luigi Ferdinando Marsili in his Historoire Physique de la Mer (1725).

Colossi with Feet of Clay–Stable Theories and Fragile Foundations

Olival Freire Junior
Universidade Federal da Bahia, Brazil

Many of our best scientific theories exhibit the common feature that their wide acceptation or use, thus their stability, are paralleled by a persistent and sometimes growing dissatisfaction with their foundations. The most conspicuous case is the 90-years old controversy on the good foundations of the successful quantum. However, quantum theory is not alone. It was also the case, for instance, with Newton’s mechanics and absolute time and space, differential calculus and its foundation, the role of the elusive ether in the propagation of the electromagnetic phenomena, the explanation of the mechanism for the Darwinian natural selection principle, the mechanic foundation of the second law of thermodynamics, and the explanation for Wegener’s tectonic plates. Thinking about this coexistence of stable scientific theories with their uncertain foundations may shed new light on the public image of science and illuminate science’s strengths as derived from their historical constitution and not from some clear cut or axiomatic foundations or even from once desired unified science. These reflections require both historical studies and philosophical investigations thus contributing to filling the contemporary gap between these two fields. This session brings together historical case analysis and philosophical reflections about the coexistence, not always peaceful, between successful scientific theories and their disputed foundations. ()

This metaphor was used by Franck Laloë in his book “Do we really understand quantum mechanics?”

Comets and Courts in Early Modern Germany

Patrick Boner
University of Oklahoma

Soon after a bright light blazed in the sky in 1604, Johannes Krabbe declared that he had accurately predicted it down to the month and year. From the royal court at Wolfenbüttel, Krabbe measured the magnitude and motion of the comet “beyond the sphere of Saturn.” Krabbe represented a growing number of astronomers who projected the principle of parallax to the heavens, abolishing the solid celestial spheres and countering the cometary theory of Aristotle.

In the following presentation, I examine the career and cosmology of Krabbe, including his conflict with Johannes Kepler, who defined the comet as a new star deprived entirely of parallax. While Krabbe considered novel ideas about the physical nature of the heavens, his account reflected a relatively standard view of astrology across Lutheran Germany. Despite uncertainty in the science of the stars, Krabbe held out hope for the future. “Wise astrologers will one day determine the causes for why comets appear,” he concluded.

Competing in Completeness: Giovanni Battista da Monte’s “Consilia” in Varying Editions in the Late 16th Century

Volker Hess
Charite, Berlin

When Giovanni Battista da Monte died in 1551, he had not put to paper a single line of his medical Consilia (advice given to patients during bedside consultations) that were praised so highly by his students. In contrast to common practice, da Monte’s
Consilia comprised not only personal advice for rich patients but also clinical lectures that were often delivered together with one or two other medical professors. Between 1554 and 1587, eleven editions of the Consilia were published by former students, at least nine of them by Johannes Crato von Kraffttheim, personal physician of Maximilian II, two by Giralomo Donzellini, an Italian physician, and the rest by Polish physician Valentin Lublin. Each of them promised to cleanse the text of contaminations caused by earlier editions, to correct misunderstandings, and to restore the original wording. By comparing the editions of da Monte’s Consilia this presentation will demonstrate the paper techniques used by his editors: Correcting misunderstandings; reinserting what had been omitted; translating Italian passages into Latin; augmenting earlier text versions based on notes from other students. In a competitive process driven by the printing press and based on the humanist textual method, an â€œoriginal textâ€ was constructed by printers, publishers, typesetters, deskmen, and editors.

On 20 January 2018 RocketLab, a space-tech start-up, launched the Humanity Star, a metre tall ‘disco ball’ intended to “blink brightly across the night sky to create a shared experience for everyone on the planet”.[1] The launch provoked a range of responses from the scientific community, with some calling it “graffiti”, and astronomer Caleb Scharf going so far as to say “It’s hogging some of that precious resource, the dark night sky, polluting part of the last great wilderness.”[2] In this paper I argue that Space has been re-cast by interested Actors from being a wilderness to be conquered, to a wilderness to be cherished and protected from private-sector and ‘non-scientific’ threats. In this paper I build on the previous work of Launius, Siddiqi and others in establishing a global history of spaceflight by contextualising the most recent era of ‘open’ Space in the history of other areas of international governance. In doing this I engage with the nexus between technology and international law by challenging the conception that space is still a ‘remote commons’ which is exploited for financial, technological or military gain. Rather, I argue that Space should better be understood as an...

**Constructing Technologies and Imaginaries of Mass Migration: The Case of Western Mexico**

**Mateo Carrillo**  
**Stanford University**

My paper, framed by the beginning of World War II and the end of the guest worker Bracero Program in 1964, examines the growth of binational transportation and hydraulic networks, industrial agriculture, and rural Mexican outmigration. This study of technocrats and campesinos, industrialized landscapes and bodies, and human movement and hubris analyzes the intersections of the infrastructures, policies, and imaginaries of mobility that entrenched a culture of migration in western Mexico. An official, zealous commitment to postwar public works expansion transformed Mexican realities and notions of spatial and upward mobility as well as perceptions of space, time, and belonging. By imposing statist, modernist visions of order and progress through domestic civil engineering and US-backed agricultural regimes Mexican elites and técnicos helped aggravate land loss, joblessness, debt, and inequality in the Mexican countryside. These policies intensified rural migrant flows and altered migrant trajectories to the United States via rapidly expanding binational highway and transportation networks, informing dehumanizing and criminalizing binational discourses of transnational Mexican migrancy. These narratives, in turn, shaped notions of illegality and race which ultimately restricted Mexican migrant mobility and denied migrants substantive citizenship rights in both polities.

**Contending Positions: Science, Medicine, and Religion in 19th- and 20th-century Mexico**

**Jethro Hernandez Berrones**  
**Southwestern University**

How does the process of medicalization take place when historians examine not reformers, but institutions and populations subject to medical reforms in a specific country? Traditional histories of medicine have focused on the steps “great medical men” took to adapt European medical sciences to the Mexican context. While valuable, this approach assumes that the process of medicalization concludes with the creation of modern medical institutions. But here is just where it starts. In the mid-19th century, most of Mexico’s population was mestizo, agrarian, Catholic, and illiterate. White and literate criollos lived in a few major urban centers from where they governed the country or administered their large states. Part of the latter group, doctors sought to modernize medical institutions by adopting enlightened science. The details of how different groups responded to this process of medicalization are just beginning to be studied. Papers in this panel examine the tensions between science, religion, and state-building in the medicalization of Mexican society in the 19th and 20th centuries at several levels: parishioners and their congregations confronting smallpox vaccination, patients and doctors at the maternity ward of an urban hospital, a “folk saint” and its devotees in the US-Mexican border, doctors questioning the epistemological, moral, and gender implications of the termination of pregnancy, and homeopathic practitioners challenging the straightforward adoption of Bacteriology and Physiology in medical programs and practice. The picture that emerges is one of negotiations where medical traditions merged into plural approaches to healing.

**Corporate Science in the Banana Republics: Research and the United Fruit Company Lands**

**Megan Raby**  
**The University of Texas at Austin**
The United Fruit Company (UFCo) is notorious for its influence on Latin American political and economic life during the twentieth century. UFCo’s power was rooted in its control and transformation of land. By the 1930s, it controlled more than 3.5 million acres. While converting lowland Caribbean rainforests into banana plantations, the company also remade Central American nations into neocolonial “banana republics.” This checkered history is well known to historians of business, environment, and U.S.-Latin American relations. Historians of science, however, have paid little attention to UFCo, despite its major sponsorship of scientific research and status as a prototypical transnational corporation.

This paper examines the UFCo Research Department as a case of science at the nexus of state and corporate power, focusing particularly on the relationship between the company’s administration of scientific research and its control of land. UFCo engaged in a wide range of research in agriculture, botany, entomology, nutrition, medicine, chemistry, and even archeology. It administered an array of research sites, from the Lancetilla Experiment Station, which explored the possibilities of crop diversification, to laboratories at La Lima, which developed the chemical controls necessary to maintain vast monocultures. UFCo’s ownership of land significantly shaped scientists’ access to tropical environments. At the same time, its (fluctuating) sponsorship of science gave it new means to control and transform Latin American landscapes. Corporate science was at the center of land disputes and contested visions of economic development in the twentieth century, leaving legacies that remain in the landscape today.

Creationism Comes to Mexico: From Divine Creation to Dinosaurs in Zacatecas, Mexico

Jorge Romo
National Autonomous University of Mexico

Creationism goes global. Although there is no influential creationism in Mexico, like the one existing in the United States and other countries, scientific creationism has been promoted in churches, schools and bible workshops in the last three decades. In this flash talk, I will make a quick reference to the legal and political context that has allowed this change of affairs that challenges the strong secular tradition in public education, and call attention to two influential representatives of this movement: Mexican creationist Ruben Berra, and John Morris Pendleton, an American scientific creationist who is looking for dinosaurs in the state of Zacatecas, in order to show the world is 6,000 years old.


Ekaterina Babintseva
University of Pennsylvania

The 1960s-1970s were marked by a profound interest in creative thinking among Soviet psychologists and educators. They connected creativity to the country’s economic success in the approaching era of computerization and defined creative thinking as the ability to solve problems, make discoveries, and produce inventions. This definition of creativity led several Soviet institutions to work on the development of techniques and technologies for the control and cultivation of creative thinking in students. Such research first originated at the Laboratory of Programmed Instruction (LPO) of the Academy of Pedagogical Sciences and, later, in the 1970s, was also conducted at the Department of Psychology of Moscow State University (MSU) and the Council for Cybernetics.

This paper traces various attempts of Soviet psychologists to formalize problem-solving and write special teaching prescriptions to train creativity in students. I begin by showing how in the 1960s, the LPO worked to simulate thinking processes algorithmically. While in the 1960s, the LPO shared the cyberneticians’ belief in the omnipotence of algorithms, in the early 1970s, they came to realize that algorithms are too rigid to describe how humans solve problems. The growing skepticism about the
Creatures of Habit: Anecdotes and Animal Reason

Henry Cowles
University of Michigan

Can anecdotes be evidence? In general, “anecdotal evidence” is deemed potentially misleading (if not an oxymoron). But there are certain situations, and certain fields, in which anecdotes register phenomena that can be hard to capture, control, or quantify. Anecdotes are often the only way to record chance occurrences or account for inner experience. Because they can carry moral values as well, anecdotes also trouble the is/ought divide in scientific discourse. A history of efforts to collect, analyze, and use anecdotes—as well as the opposition to such efforts—might thus provide a kind of counter-history to the coalescence of evidentiary standards in modern science. This paper addresses the authority of anecdotes in the context of animal psychology, specifically as the field developed in the latter half of the nineteenth century. With the rise of experimentalism and the decline of introspection, animal anecdotes occupied a vexed middle ground in the work of such figures as George John Romanes, Conwy Lloyd Morgan, and Edward Thorndike. On the one hand, anecdotes about “other minds” were seen as superior to introspective data; on the other hand, such evidence resisted experimental control, thwarting attempts to standardize research subjects. Through a case study of the American beaver, this paper recovers the role of anecdotes both in scientific studies of animal reason and in the unmaking of situated knowledge, showing how “anecdotal” became a bad word that was used to reject some scientific claims in favor of others.

Critiquing the “Biomedical Model”: A Vehicle for Alternative Narratives of Disability

Andrew Hogan
Creighton University

In a 1977 Science article, psychiatrist George Engel critiqued the “biomedical model” approach to disease. Engel argued that this biomedical model, which accounted for disease based on somatic and molecular traits, lacked an examination of equally important psychological and social aspects. Engel proposed an alternative “biopsychosocial model” for understanding the challenges of disease. Many science and health professionals joined Engel in his critique of the biomedical model as an overly reductive worldview. Molecular approaches to understanding chronic disease and disability were becoming increasingly prominent in the 1970s, but offered limited perspectives on causes, classification, and management. In this paper, I argue that critiques of the “biomedical model” were an important vehicle by which alternative narratives of disability entered the classification systems of biomedical professionals. Historians have described biomedical classification as a fraught arena where social, moral, and biological assumptions intersect. I draw on archives, published literature, and interviews to examine evolving conceptions of disability in multiple editions of the World Health Organization’s International Classification of Impairments, Disabilities, and Handicaps (ICIDH). The first edition of ICIDH, in 1980, was an early response to biomedical model critiques. ICIDH added a focus on the social consequences of disease, but was widely criticized for maintaining a biomedical perspective on the somatic origins of disability. In response, the second edition in 2001 adopted Engel’s “biopsychosocial model”. Nonetheless, disability advocates continued to critique the WHO disability classification, as part of their ongoing efforts to encourage the uptake of alternative social and minority group models of disability.
Crossing Boundaries, Sharing Spaces: 20th Century Biologists and Economists Model Growth

Jason Oakes
UC Davis

This panel considers the proposition that economics “has always been a science of life.” I agree, and offer three instances of the transfer and exchange of models, tools, and matters of concern between economists and biologists modeling growth (population and economic) in the 20th century. I argue that by looking at them as a group we can trace the development of attitudes towards life and growth as a problem, though each case is embedded in its own time and place. First, Raymond Pearl and Alfred Lotka’s work on life tables and the logistic curve offers a view into an early relationship between industry, government, and academic research impacting ecology, life insurance, and demography. Second, I show how Garrett Hardin’s influential paper, The Tragedy of the Commons, was taken up by two distinct groups of political economists in the Public Choice school. James Buchanan and Gordon Tulluck adapted Hardin’s model to support their analysis of rent-seeking, while Elinor Ostrom’s Workshop in Political Theory and Policy Analysis reworked the Tragedy of the Commons into a fate that could be avoided. I conclude with speculation about why these two disciplines, though far separated by traditional academic divisions, have almost compulsively looked over each others’ shoulders in multiple instances. Why do economists and biologists care enough about one another to want to borrow each others’ tools?

Cryo-Histories: Telling “Other” Stories of Science in Frozen Lands

Dani Inkpen
Harvard University

In the 2017 HSS Distinguished Lecture, Sverker Sörlin described the Northern Turn in the history of science; a wave of recent histories examining knowledge-making in the Arctic. Expanding this Northern Turn, the papers in this session explore ways of telling “other” histories of cold places. Cryo, meaning “cold,” invokes the high latitude and high altitude geographies under consideration, long caricatured as extra- or a-historical spaces. Telling cryo-histories means taking seriously the historicity of such places, telling stories in which cultural geographies and contingent histories meet in the production of knowledge and place. Such stories are timely. 2018 marks the 200th year since Mary Shelley conjured the image of an otherworldly frozen land, banishing Frankenstein’s monster to an arctic imagined outside the natural and political order. 2018 also marks twenty-five years since historians began analyzing the ways that science in frozen lands generates “others,” including work from Lisa Bloom (Gender on Ice, 1993); Trevor Levere (Science and the Canadian Arctic, 1993), and Michael Bravo, (“The Accuracy of Ethnoscience…, 1996). These histories examined how frozen landscapes and their denizens were figured as “others” against ideas of Euro-American imperialisms, nationalisms, heroic masculinity, and metropolitanism. This session explores the continuing possibilities and limits in “other” cryo-histories of science a quarter-century later. Playing with familiar categories—wilderness; laboratory-field dichotomy; heroism; Western science; Indigenous knowledge—we consider not just other stories but how we tell them, thinking afresh about the conceptual tools historians deploy in histories of polar and alpine science.

Culpability as a Psycho-Historical Problem: The Temporality of Responsibility in 19th-century Vienna

Richard Spiegel
Princeton University

To what extent can a criminal action be positively attributed to a particular psychological cause at a specific moment in time? By using a prominent case of matricide from 1870s Vienna to draw out just how urgent and messy this problem was, my paper explores how Viennese jurists used contemporary theories of mind to evaluate individual culpability in the courtroom. How were the circumstances of a culprit’s life history—upbringing, family life,
education, social position--exculpatory or explanatory of the mental events that eventuated a criminal act? I look at how jurists used contemporary theories of psychology to disambiguate juristic from medical expertise and to insist on the primacy of the latter over the former in legal practice. To the extent that the relationship between mental events and criminal acts could be approximated, it fell to the jurist to interpret the specific moment of a crime in relation to the "total development" of the mind of the accused. I explore how the idea that the totality of an individual's life history should serve as the explanatory framework for interpreting the subjective moment of a criminal act. Psychology furnished legal thinkers, I suggest, with a manner of understanding and operationalizing the historicity of personal identity before the law.

Cybernetics in China: Qian Xuesen and Somatic Science

Bo An
Yale University

The paper is an interdisciplinary history of cybernetics in the People’s Republic of China. Following the career of the founding cyberneticist and scientist Qian Xuesen (1911-2009), it presents a broad picture of the reception and legacy of cybernetics across social and human sciences in the second half of the 20th century and beyond in China.

The history is divided into three periods by which the presentation proceeds in chronological order. Cybernetics emerged in China in the 1950s—the first period—as an interdisciplinary science deeply tied to applied mathematics and large-scale project management. Influenced by Qian Xuesen, the development of Chinese cybernetics was connected to but ultimately different from both those of the Soviet Union and the United States. Its approach to cybernetics became more distinctive during the second historical period marked by the Sino-Soviet split of 1958 and the Cultural Revolution which ended in 1976. Its revival after the 1970s constituted the third period, when cybernetics, along with information theory and systems theory, attained the status of universal sciences and was applied not only in engineering, but in social sciences and humanities such as economics, environmental science, education, and world history as well. Here, I consider renti kexue (somatic science) of the 1980s, by situating it in the larger historical context outlined above, as a special case where cybernetics, traditional Chinese science and medicine, pseudoscience, socialist science policy, and Post-Mao culture and politics intersect. By way of conclusion, I will briefly discuss the contemporary legacy of cybernetics in China.

Darwin’s Drawings: The Victorian Geological Field Guide and Imperial Resource Management

Anne Ricculli
Drew University

Victorian-era Geological Society of London members incorporated Charles Darwin’s illustrated geological coral growth argument in field guides used by Geological Survey students and naturalists’ clubs. This talk traces the evolution of Darwin’s images, first viewed in 1837 during his research presentation at Somerset House and later published in The Structure and Distribution of Coral Reefs (1842) and Journal of Researches (1845). Using annotated versions of Darwin’s woodcuts, geologists Joshua Trimmer (Practical Geology and Mineralogy, 1841), Henry De la Beche (The Geological Observer, 1851), and Thomas Wright (Proceedings of the Cotteswold Naturalists’ Field Club, 1868) demonstrated for specific audiences why, how, and when Britain’s stored wealth in local coral fossil limestone deposits was accumulated. Through these case studies I argue that Geological Society of London participants framed the volume of indigenous coral reserves in terms of colonial-region coral growth, thus encouraging nineteenth-century field guide readers to engage in debates regarding the interpretation of Britain’s geological past, present, and future in the context of the geologists’ role in imperial resource management. More broadly, these case studies disclose the reverberations of Darwin’s coral growth
theory among Geological Society members. In field
guides designed to educate Victorian readers,
geologists situated the focus of their emerging
professional practices within the integration of theory
and practice in global coral research conducted
throughout the British empire.

**Darwin’s Shrub: The Sprouting of the Tree of Life**

Norbert Peeters
Leyden University

Darwin’s idea of an evolutionary tree of life sprouted
from this and other tree-sketches of his early
notebooks (Notebook B, 1837), illustrating the way
in which all species are connected by common
descent. In On the Origin of the Species (1859), there
is one “indispensable [illustration] to show the nature
of the very complex affinities of past & present
animals.” This illustration is a rather abstract shrub-
like diagram that played a pivotal part in explaining
his principle of “descent with modification by means
of natural selection.” Darwin’s tree of life grew out
into the single most important plant-metaphor in the
natural sciences. Although tree-diagrams were not
new to the natural sciences, Darwin’s evolutionary
tree challenged an important doctrine of natural
philosophy. When Darwin published the Origin, the
Aristotelian order of nature still held sway over
Western thinking. The natural order was still depicted
as a linear ladder (scala naturae) or “chain of beings”,
ranging from the “lower” life forms (plants) to the
“highest” life forms (humans). Darwin too found it
difficult to distance himself from a ladder-like
conception of nature. To this day evolution is still
often depicted as a linear progressive process from
lower to higher life forms. During this talk we will
look at the development of “tree-thinking” in
Darwin’s work and how it supplanted his “ladder-
thinking”.

**Data Rituals: Measuring and Recording Height and
Weight in Baby Books, 1872-1940**

Fenneke Sysling
Utrecht University

This paper looks at records of baby height and weight
in baby books in the US between 1872 and 1940.
Baby books, books in which parents record
information about their child, are still a familiar
object in households with young children. These
books, this paper shows, are a unique source in which
we can follow practices of measuring and
quantification from the doctor’s office and the health
departments into the household. Although the use of
weight and height records by parents might appear to
exemplify institutional biopower manifested through
internalised self-monitoring, I argue that keeping a
record of baby’s growth in a baby book was, in fact, a
ritualised version of measurement. Using both work
by historians of science on quantification and
anthropological literature on ritual and selfhood, I
argue that this ritual of measuring and recording
symbolised and realised the transformation of the
baby from newborn status to child and new
personality the family. With the transfer from medical
protocol to family practice in baby books, the
recording of height and weight thus took on a
radically different meaning.

**Decoding the Secrets of Nature: Robert Boyle and
Cryptographic Metaphors in Seventeenth Century
Science**

Dana Matthiessen
University of Pittsburgh, History & Philosophy of Science
Dept.

This presentation seeks to show how naturalistic
attitudes and interests that developed in the sixteenth
century were a part of Boyle’s intellectual milieu.
Their influence is seen in the evolution of his
reflections on natural philosophy. From early in his
natural philosophical career, Boyle routinely appealed
to the Reformation-era notion of nature as divine
text, the elements of which functioned as letters in an
alphabet. He framed his inquires in these terms at a
time when his forerunners and contemporaries--
Bacon, Hartlib, Wilkins, Beale, Wallis, Hooke; and
others--were devoting increased attention to the
workings of language, cryptography, and the need for
a systematic linguistic representation of the world.
These factors, taken alongside Boyle’s passion for alchemy and the discourse of secrecy and concealment accompanying this practice, gradually caused him to conceive of the “book of nature” as an encrypted text deciphered by mechanical hypotheses. This metaphor, which quickly became popular with other adherents to the mechanical philosophy, helped Boyle articulate elements of his natural philosophical method in a straightforward way, frame its epistemological limits, and situate it within a broader natural theological context.

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**Defining “Trans” in the 20th Century: An Exploration of Language in Cases of Sex-Gender Nonconformity**

D Cicchiello
Oregon State University

The contemporary concept of “transgender” is based on the nuanced theoretical differences between biological sex and socialized performative gender roles; attempting to apply this contemporary distinction to historical actors has the potential to limit the depth and breadth of source material. A historical analysis of 20th century trans medicine must begin with an exploration of medical literature from the period to better understand how gender nonconformity was described, explained and approached as a medical condition. Unpacking the language systems surrounding the phenomenon of trans identity, particularly the language systems in medical literature, will demonstrate the way physicians and, thus, larger social communities understood those whose gender identity failed to align with their biological sex.

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**Delivering Knowledge: Translations for Jewish Midwives in Eighteenth-century Amsterdam**

Jordan Katz
Columbia University

Midwifery provides a critical lens into the influence of women serving in medical capacities in early modern Europe, but this unique position has not been sufficiently explored with regard to Jewish communities. This paper examines the Yiddish translation of a Dutch treatise on reproduction and childbirth as a way to investigate the circulation of medical knowledge among early modern Jewish midwives. Commissioned in 1709 by an Amsterdam Jewish midwife, the resultant manuscript bears the name of the midwife alongside her translator, highlighting the crucial role of translators in communicating medical knowledge to Jewish women. I argue that by transmitting one culture to another, translators emerged as pivotal figures who could decide how information was phrased and packaged, and could fundamentally alter concepts in the books that they were supposed to “simply” translate. Especially with regard to Jewish women, who often could not read the local vernacular, translation into Yiddish became an important vehicle for accessing midwifery handbooks. In the present case, the Yiddish translation differs from the original Dutch work in numerous ways, suggesting the translator’s decisive choices about what to preserve or alter. Furthermore, an investigation of the sources of authority in these works allows us to establish some of the medical influences of early modern Jewish midwives. I thus provide a starting point for considering Jewish midwives within an international system of medical and scientific communication, whose content flowed between vernacular and elite practitioners in a way that makes clear boundaries or hierarchies difficult to delineate.

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**Descartes in a Frieze: Scholasticism and Popular Science in the ‘Essais’**

Abram Kaplan
Columbia University/Harvard University

Abstract: My method of drawing tangents, René Descartes told Marin Mersenne, “is the most noble way of demonstrating that can be, namely, that called a priori.” Descartes turned to scholastic terminology to describe his new mathematics; yet its practice involved compound compasses and scratched-out symbols, the former an emphatically banausic generalization of Euclidean practice, the latter an
adaptation of merchant mathematics. Tools-based practice permeated the Essais that Descartes presented as instances of his general method. My focus here is not on Descartes’ use of artisanal techniques so much as on his efforts to naturalize these techniques within scholastic philosophy or scientia. Much has been written about the efforts of higher-status practitioners to occult the manual or intellectual contributions of technicians; I look at the arsification of scientia from a different perspective, focusing on Descartes’ efforts in the Discours and accompanying Essais to persuade both gentlemen and philosophers that they should care about craft. These efforts were themselves a kind of art: for example, Descartes referred to his suppressed physical treatise as a painting that represented his arguments “in a frieze.” Understanding the artistry of Descartes’ rhetoric, I argue, will require us to reconsider not just the relationship between ars and scientia, but also our own prejudices about the putatively doctrinal aspirations of the new science.

Discovering Another Civilization through an “Othered” People: Investigations of Radioactivity at the Site of the Tunguska Explosion

Andy Bruno
Northern Illinois University

In 1908 a huge blast occurred over the Siberian taiga in a land inhabited primarily by indigenous Evenki. When Soviet scientists first investigated the event two decades later, they assumed it had been caused by a meteorite. Yet traces were never found. This inconclusiveness eventually led to wide-ranging speculations, including the idea that the explosion was caused by an accident of a nuclear-powered alien spaceship. Though initially limited to the realm of science fiction, this nuclear hypothesis inspired generations of amateur researchers to undertake expeditions to the Tunguska site, where, among other things, they searched for evidence of an atomic explosion. This paper will look at these efforts to determine possible radioactive contamination in the Tunguska site. Working during the peak days of fallout from nuclear testing, these researchers were intrigued when their radiometers buzzed in certain spots. They eventually turned to trying to acquire all sorts of indirect evidence that the blast was nuclear, including from the health records and testimony of the Evenki who had been in the region. This research

Designing with Purpose: Human Factors Engineering at NASA

Layne Karafantis
NASA

Human factors engineering professionalized in the early years of the Cold War due to the development of safety-critical systems—those in which failures would be catastrophic. Often used interchangeably with ‘ergonomics,’ human factors engineering (HFE) not only considers physical comfort in the composition of objects and systems, but seeks to optimize human performance through strategic design principles drawn from psychology, cognitive science, and other fields. The origins of HFE are typically traced to Taylorism, but it was not until the Cold War era that the field became widely researched and implemented in a variety of areas. The American military long held interest in HFE. Earlier called ‘applied psychology’ or ‘human engineering,’ branches developed tactics to improve selection and training techniques; in later years, engineers applied research in the construction of weapons systems and command rooms. By the 1960s, largely due to Cold War imperatives and the development of new computing and communications technologies, many federal, company, and university laboratories were conducting HFE research in efforts to better understand man-machine interactions. NASA, an agency itself borne of the space race between the United States and Soviet Union, has been a key contributor to the development of human factors engineering. Along with pioneering biomedical studies necessary in determining how man would physically venture into space, NASA investigated how displays and controls needed to be placed aboard spacecraft so that astronauts would be best able to process complex information and complete tasks.
reflected a view of radioactivity as something that migrated through interstellar space into the bodies and memories of the indigenous peoples who had been most affected by the explosion. The ethnographic and medical orientation of these researchers can be seen as a method of bolstering their expertise within a scientific community that was sometimes dismissive of their amateur status. In this way radioactive indigeneity served in debates about what counted as legitimate Soviet science.

**Documenting Plants with Science and Art: The Johannes Harder Herbarium**

Maura Flannery  
St. John’s University

Herbaria, collections of preserved plant specimens, were first created in the early modern period in the 1530s. They were indicative of a greater interest in careful observation and correct identification of plants beyond written descriptions usually based on ancient writings, particularly on the first-century CE herbal of Dioscorides. As botany developed, the first printed herbals with accurate images of plants appeared in the 1530s and along with herbaria, provided a means for botanists to document information about plants more accurately than did the texts of the time. This paper will examine a herbarium that the German apothecary, Johannes Harder, created around 1595. In an effort to provide as much visual information as possible, Harder filled in missing parts such as petals, roots, leaves, and even entire flowers. I will argue that this blending of art and science is an example of one of several experiments in visual presentation developed at the time to depict plants accurately. I will draw on the work of Florike Egmond on early modern collections of watercolors and recent studies of nature printing at that time, as well as on Omar Nasim’s exploration of how drawing can be fundamental to the formation of scientific ideas.

**Dogs with Character: Perceptions of Breed-Specific Mental Traits in Postwar United States**

Amir Zelinger

The paper discusses the survival of racialist ideas in theories about dog breeding in post-World War Two United States. Its main focus is the notion that dogs of the same breed share similar mental traits and that these traits are hereditary. This notion had its roots in the 19th century, when dog breeding was heavily influenced by racial science. According to race theories, the character of individuals is a derivative of their racial affiliation. However, when racial science was discredited after the Second World War especially this idea of the racial basis of character came under attack. Postwar dog breeding did not exhibit an analogous questioning of the idea of breed-specific mentalities. On the contrary: in the decades following the war this idea became ever more powerful. That had to do with the fact that after the war dogs started to be identified more strongly than before with middle class family life and were increasingly regarded as family members. In this context, one of the most intensely discussed questions about dogs in postwar America was what breeds possessed a character that was best suited to life in the company of children. On the other hand, postwar suburbanization also generated an increased interest in watchdogs, which in turn raised the popularity of breeds reputed for their aggressiveness, like the German Shepherd and the Doberman Pinscher. The paper’s conclusion will connect the historical development of such breed stereotypes to present-day controversies around the stigmatization of certain breeds as innately violent (“breedism”).

**Early Modern Drugs in Print: Pierre Pomet’s “Histoire General des Drogues” and the Business of Credibility**

Laia Portet-I-Codina  
University of Cambridge

This paper explores the entanglement of scholarship, commerce, and leisure that accompanied the spread of scientific literature throughout the seventeenth century in France by focusing on the popular treatise of drugs printed in 1694 by a Parisian grocer-druggist.
By uncovering the epistemological strategies, the materials, and the individuals involved in the making of Pierre Pomet’s "Histoire Général des Drogues", this study argues that by 1700 drugs became a contested field of expertise and a subject of interest to a wider and more heterogenic public. Encouraged by different factors, traders, travellers, curiosi, educated women, artisans, courtiers and civil servants joined physicians, apothecaries, and naturalists in furthering their understanding about newly discovered simples and how they compared to well-known products provided by indigenous specimens. The economic, intellectual and epistemic importance that simples acquired throughout this period was reflected in and affected by the publication of an increasing number of medical books, pharmacopeia and botanical treatises. Each publication contributed to shaping local consumption and fostering the commodification of drugs in its own way. The "Histoire Général des Drogues" showcases the importance of the market to scientific knowledge and vice-versa while illustrating the centrality of print in providing non-educated individuals such as Pomet an active and direct participation in the production, circulation and use of scientific knowledge -natural history and medicine in particular.

Economics as a Life Science

Jonny Bunning
Yale University

From 1440 to 1870, the Transatlantic Slave Trade (TAST) produced the largest forced migration in history; more than 11 million enslaved Africans were transported from Africa to the Americas. Throughout its more than 400-year span, economic, political, agricultural, and natural forces modulated the TAST. Natural forces that affected the TAST included droughts, which affected agricultural productivity over Africa.

Historians have suggested that severe droughts increased the raiding of villages that led to the increase in the transport of enslaved Africans to the Americas.
To date there has been no quantitatively based study that links El Niño and African droughts with increases in slave exports. With this in mind, the central hypothesis of this study is that El Niño, a phenomenon that affects global weather patterns, had a significant influence on the TAST. To test this hypothesis, a statistical analysis based on a historical El Niño dataset, which is used as a proxy for African droughts, is combined with the slave voyages data set. The analysis shows a statistically significant correlation at a four-year lag between El Niño and an increase in the number of enslaved Africans transported from West Africa to the Americas. A land-vegetation-atmosphere feedback mechanism is presented that provides a physically based linkage between El Niño, drought, and the TAST. The results are discussed in light of present day climate change and its effects on conflict and migrations in the Middle East.

**Embodying Productivity: Chinese Sericulture in Colonial Xinjiang, 1878-1889**

Peter Lavelle  
*Temple University*

Histories of science in late nineteenth-century China often examine the circulation of scientific knowledge from Europe and the United States in China and the institutions and people which facilitated such circulation. This paper seeks to move beyond this dominant geographical paradigm by exploring an under-appreciated side of Chinese science in these decades: the circulation of Chinese technology and expertise within Asia. In the 1870s and 1880s, statesmen in the Qing empire sought to take advantage of the booming global demand for silk and reinforce imperial control in Xinjiang (Chinese Turkestan) at a time of geopolitical instability by undertaking a program of sericulture improvement among the primarily Turkic Muslim inhabitants of the region. They built sericulture bureaus and hired Chinese experts to train Turkic apprentices in all aspects of the silk production process. One cornerstone of this program was the attempt to transplant living organisms—silkworms and mulberry trees—from eastern China’s Zhejiang province into the empire’s Central Asian territory. These organisms were employed by their Chinese handlers as embodied technologies whose morphology and productivity represented claims to Chinese expertise about the natural world vis-à-vis their Turkic colonial subjects. This paper pays attention to the role of these embodied technologies in the circulation of Chinese knowledge within and beyond the walls of the sericulture bureaus.

**Embracing the Electronic Brain: Cold War Entanglements of Organisms, Minds, and Computers**

Michael McGovern  
*Princeton University*

During the 1950s, a surge of new research describing the electrophysiology of neural communication, behavior, and higher-order mental processes emerged alongside the first electronic, stored-program computers. Growing public consciousness of the affinities between information technologies and minds charged investigations into the nature of brain activity and brought the brain-computer metaphor into circulation. Such research was undertaken in mixed settings that enabled the breakdown of distinctions between describing, modeling, and engineering as styles of thought and practice. In this panel, we explore how these metaphorical affinities galvanized new practices, resulting in a diverse set of approaches that were often mutually incompatible. Historians of science have long been fascinated by midcentury discourses on the limits of human rationality, or conversely, its extension into the worlds of transistorized circuits and animal behavior. These papers address a range of questions to push such inquiry forward and unsettle existing analytical categories. Where were new disciplinary boundaries drawn or existing ones gerrymandered? What role did new technical expertise, and the actors who bore it, play? What counted as ‘life’ and how did the cognitive order of nature disrupt, reinforce, or re-scale existing hierarchies of natural history? Moreover,
how can we frame the lasting legacy of this period of ferment? Pushing at the boundaries of sweeping characterizations like information discourse, neuromolecular turn, and Cold War humanity allows us to re-imagine the practice, politics, and language of the Cold War mind and brain sciences.

Entomologist to the Farms: Leopoldo Uichanco and the Growth of Philippine Rural Agriculture

Ruel Pagunsan
University of the Philippines, Diliman

This paper examines the relatively unexplored role of entomologists in the history of Philippine agriculture. Looking particularly at the life story of Leopoldo Uichanco, revered as the “father of Philippine entomology,” it interrogates twentieth-century state-making in rural agricultural communities. Uichanco participated in national projects that sought to modernize agricultural production in the country. As a government fellow, he was sent to Harvard University for graduate training, becoming one of the first Filipinos to obtain a doctoral degree in entomology in 1922. Serving as dean of the University of the Philippines College of Agriculture for twenty years, Uichanco spearheaded programs aimed at assisting community farmers. These programs would then be institutionalized through the extension office that oversaw the dissemination of agricultural knowledge from laboratories to fields.

By examining Uichanco’s biography, the paper offers insights on the professionalization (and nationalization) of entomology and the growth of rural agriculture. His early training in entomology was in systematics, but it was in the fields of insect ecology and economic entomology that his scientific contributions were widely recognized. Uichanco’s research on the locust problem, crop pests and pest control figured well into government programs in rural communities. In one of his articles on the history of Philippine entomology, Uichanco expressed the need to empower community agriculture as essential component of national development.

Erwin Schrödinger as a Modernist

Lisa Barge
University of Toronto Mississauga

Humanistic thinking played a significant role in the thought of one of modern physics’ greatest figures, Austrian physicist Erwin Schrödinger, whose work extended far beyond his contributions to quantum mechanics. Nonconformist that he was, Schrödinger was also a prolific cultural writer, whose work drew on modernist cultural themes well beyond his own professional field, particularly the critique of Western scientific and objectivist thought as refracted through his fascination with Eastern Vedic philosophy. Though this fascination was amateur, it had far-reaching implications for Schrödinger’s views on science, not only in his native field of physics, but also in the field of biology. I argue that Schrödinger can be claimed as a modernist figure moving between the two “cultures” of science and the humanities. Schrödinger’s interest in Vedic philosophy informed not only his position within the metaphysical crisis surrounding quantum mechanics in the first half of the 20th century, but also his forays across scientific disciplinary boundaries and into the field of biology, where his musings (inspirational to Watson, Crick and Wilkins), borrowed from the wider modernist Germanic cultural tradition of Lebensphilosophie, as Vitalism was then known in the German-speaking world. This paper argues that, problematic though his dedication to Vedic philosophy may have been, it cannot be disentangled from his scientific thinking.

Estrogens, Androgens, and the Development of the Concept of Hormone-Dependent Cancers

Gina Surita
Princeton University

The concept of hormone-dependent cancers, or cancers that are sustained by particular hormones, developed slowly during the period from about 1940-1990. I chart how the development of the notion of hormone-dependent cancers initially relied upon assumptions that cast androgens and estrogens, prostate cancer and breast cancer, as opposite ends of
a gendered hormonal binary. Starting in the 1940s, cancer researchers began to argue that “male sex hormones” (androgens) exacerbated prostate cancer and that “female sex hormones” (estrogens) ameliorated it. Within about a decade, cancer researchers suggested that the opposite might be true for breast cancer. By the 1980s, estrogens had come to dominate discussions of breast cancer’s progression, diagnosis, and treatment. While historians of breast cancer and estrogen have discussed concerns surrounding estrogen exposures (debates about the safety of oral hormonal contraceptive pills, for example), they have not examined in detail the processes by which estrogen became closely linked to breast cancer. My research suggests that as breast cancer was redefined in terms of estrogen, scientific understandings of the function of estrogen shifted as well: breast cancer researchers began to emphasize the growth-promoting ability of estrogen as a central aspect of its hormonal function. This prioritization of the growth functions of estrogen complicated the gendered assumptions upon which the notion of hormone-dependent cancers initially relied. Researchers and clinicians began to suggest that estrogen could exacerbate some breast cancers not because it should be understood primarily as a “female sex hormone,” but because it could promote tumor growth.

Europe by Design: The Foundation of the European Physical Society during the Cold War

Roberto Lalli
Max Planck Institute for the History of Science

This year marks the fiftieth anniversary of a critical turning point in history with long-lasting impacts on the cultural, social and political spheres of human life. Amidst the social and political unrest across the globe, on September 26th sixty-two physicists gathered at CERN to found the European Physical Society. Among these, there were the official representatives of the national physics societies of seventeen countries of both East and West Europe who signed the constitution in spite of the political divides of the Cold War. According to the main proponent of the society, Italian physicist Gilberto Bernadini, the success of the initiative was the realization of a “dream”: the institutional formation of a single European physics community, which was a representation of a culturally unified European “nation.” This paper analyzes the foundation of the society by addressing the question of which kind of scientific internationalism the main actors were actualizing in the design and, eventually successful, realization of this idea. It will be shown that political motivations, and the notion of scientific internationalism itself, were deeply intertwined with socio-professional interests of a specific community, mostly related to the CERN environment. While the actors stressed the political character of the initiative, a major rationale for the creation of the EPS was in fact the need to solve specific issues concerning the publication venues as well as the future possibilities of cooperation and education of European physicists who still felt disadvantaged with respect to their colleagues working in the US.

Expeditions, Specimens, and Ideas

Paul D Brinkman
North Carolina Museum of Natural Sciences

Expeditions play a formative role in natural science research. Data—in the guise of key specimens or crucial experiments—are collected on expeditions. Expeditionary science has long served to bolster the collections of natural history museums. The specimens collected, as well as the publications that derive from those specimens, bring increased prestige to the sponsoring institutions. The success for a museum of a scientific collecting expedition can be judged in the short term by the sheer size of the collection gathered. Museums of many types tout the size of their collections as a proxy for their importance amongst comparable institutions. Larger collections are often interpreted as better than smaller collections, and in this context quantity takes on a quality all its own. Long term success of an expedition and a collection can be judged on factors such as the
number of new species described, or the theoretical breakthroughs made—or not made—by studying, analyzing, and interpreting specimens and data acquired. In this session, we present five views of expeditionary natural science and the results of those expeditions in terms of biological evolution and extinction.

Experiments in Colonialism & Experiments as Colonialism: The Making of the US Pacific Proving Grounds

Mary Mitchell
Purdue University

Throughout the Cold War, colonies became preferred sites of nuclear weapons experimentation. The United States initiated this trend when it began testing weapons offshore in the Marshall Islands where, between 1946 and 1958, it detonated 67 of its largest nuclear bombs. As historians of science and technology have begun to explore, American researchers engaged not only in weapons research, but also in biomedical, environmental, and anthropological inquiry facilitated by these destructive tests. Equally as important to nuclear testing, however, were US legal experiments with new territorial forms in Oceania.

This paper traces how nuclear weapons testing in the Marshall Islands entangled with the United States’ creation and maintenance of a sui generis territorial entity—a United Nations strategic trusteeship over which the US exercised near-exclusive control. Drawing on archival research in US military, Atomic Energy Commission, Department of State, and Department of Interior records, the paper demonstrates how the creation and maintenance of the UN Trust Territory of the Pacific Islands both grew out of and justified the experiments with, and related to nuclear armaments. Simultaneously, it explores how this novel, international territorial status strictly limited Islanders’ and their allies’ legal rights to object to the appropriation and use of Indigenous lands, waters, communities, and bodies for scientific experimentation. As fallout from nuclear tests ranged worldwide, the United States’ territorial experiment contained Indigenous discontent offshore.

Expertise in Art and Science II: Art (History), Conservation, and Modern Science and Technology

Sven Dupré
Utrecht University

The session focuses on the development of a science-based conservation practice and the emergence of art history as a ‘science of art’ (or Kunstwissenschaft) in the nineteenth and twentieth centuries. With which scientific methods was technique in the arts studied, and how did they relate to larger developments in modern science and technology? And in which institutional contexts was expertise in the study of art claimed? From the nineteenth century conservators turned to chemistry and material science (developing, for example, methods of pigment analysis) to understand the material make-up of art objects. Moreover, the early twentieth century saw the adoption of new imaging techniques (especially X-ray technology) requiring new observational skills from art historians. These developments are connected to the establishment of museum laboratories in the nineteenth and first half of the twentieth centuries, the disciplinary formation of art history, and the professionalization of conservation. Questions of authenticity and the attribution of art works were settled in courtrooms where judges weighed the conflicting opinions of experts. This session investigates these conflicts of expertise between chemists, art historians, artists and art dealers to understand who was considered an expert in the arts, and for which reasons. It has been argued that artistic expertise, or connoisseurship, emerged in the eighteenth century in the context of changes in the art market and museum practice. This session investigates the effects of the emergence of a science-based conservation practice and of art history as a ‘science of art’ for the delineation of expertise and connoisseurship.
By the 1970s, the world’s deepest mines were operating two miles below the surface. In South Africa, prospective miners were required to undergo an extensive acclimatization process in order to cope with the intense heat builds up in the ultra deep gold mines. To streamline and increase the efficiency of this process, companies developed a series of experimental chambers that could replicate extreme subterranean conditions above ground. Their design process addressed racial as well as material and physiological concerns, as industry scientists sought to establish a “standardized work rate” through the classification of Black miners’ bodies. In studies concerning the performance of “underweight” “heat adapted Bantu workers,” researchers revealed both disdain for and intense interest in the exposed body, as well as the tribal and racial classification schemes deployed by mining companies. Moving between the human body, the climatic room, and larger centers of scientific research, this paper questions the way engineers reconfigured the mine as a laboratory. Examining building practices that seek to reproduce (rather than mitigate) extreme environments, I analyze the way the mine was both modeled as an object and extended as a vast technical apparatus. I argue that as engineers gave new form to the underground environment, they also facilitated a bizarre faith in the ability to manage the productivity of the mine through the conditioning of workers’ bodies rather than their training, tools, or knowledge of mineral deposits.

Faces of the Scientific Self in Colonial and Post Colonial Korea

Sungook Hong
Seoul National University

For several hundred years, the traditional Korean society was governed by a group of upper-class scholars, called “Seon-bi.” Most of them were confucian philosophers (i.e. humanists), who read and interpreted Chinese confucian classics. These humanist scholars developed unique confucian virtues: humanity, humility, persistence, noble will, and courtesy. They trained their minds to make their lives coincide with these virtues. Some of them considered mathematics and harmonics to be an essential component of the training of humanist scholars, but the majority of them considered science and technology as a practical knowledge and as such to be secondary and inferior, which should be cultivated by the middle, not upper, class. Since the early 20th century, a handful of new intellectuals learned Western science and technology. Although they emphasized the utility of science and technology for decolonial nation-building and modernization, they still felt that science and technology, as practical knowledge, was regarded as inferior to the humanities and social sciences in Korea. In this context, several notable scientists such as Tae-Gyu Lee, Jang-Choon U, and Hyung-Sub Choi articulated moral virtues inherent in science such as frugality, honesty, disinterestedness, curiosity, and patriotism. These scientific virtues were proposed in such a way to resonate with traditional scholarly virtues, and they served to show that scientific activities are not simply practical, but are also deeply ethical, which are necessary for post-colonial Korea.

Fall of a Metric: The Shifting Utility of the Global Infant Mortality Rate

Emily Harrison
Harvard University

Infant mortality was a prominent object of global intervention in the second half of the twentieth century. Envisioned by liberal health experts at mid-century as a blueprint for a comprehensive and cooperative approach to social health, by the late decades of the twentieth century the problem had been reduced to a target, to be tracked and eliminated through technical solutions. While this trend can be documented in sites geographically contained within the United States, the phenomenon was produced
globally. In settings around the world, these health experts interacted with the wide variety of meanings, determinants, and responses animating the shared experience of infant mortality. Historical work on infant mortality has compared social responses to infant death and highlighted cases of international influence on the deployment of the metric, yielding insights into the production of policies and inequalities. Critical scholarship on the metric itself, however, has been limited. Using archival materials collected in personal, medical, state, and national archives in Ecuador, India, and the United States, this paper traces the shifting utility of the infant mortality rate and discusses the consequences of the particular diplomatic approach it espoused. The shifting meanings and approaches to the IMR critically elucidate historical changes in medical authority, expertise, and responsibility, as well as notions of community and the very ways of counting the “global” in human health.

Fantastic Microbes and Where to Find Them

Neeraja Sankaran
Independent scholar

In this paper I use specific examples drawn from microbiology to illustrate ways in which scientists have used the genre of fantasy—in its broadest possible sense—as speculative, explanatory and heuristic devices in their work. "A Christmas fairy story for oncologists," was a short story by the British virologist Christopher H. Andrewes in a private 1935 letter to his friend, the American researcher Peyton Rous. Using some classic fairy-tale tropes, Andrewes sketched this humorous piece to make “fantastic” speculations about the nature of certain viral infections and their place in nature, which were corroborated a few years later. A few years later, in a public lecture titled “Alice in Electronland” the Belgian-American physicist and microscopist Ladislaus Marton adapted Lewis Carroll’s beloved classic to describe previously unimaginable applications of the then new electron microscope in biology. Years later Andrewes would write a second piece “Is Sex Infectious?” for publication, a tongue-in-cheek commentary on new findings about bacteria and sex in which he adopted the language and style of Broadway author Damon Runyon. I also present How’s Life in the Colonies? A Bug’s Tale, in which a contemporary microbiologist has reimagined the world of bacteria and viruses in cartoons. Taken together, these works show that far from providing the odd creative outlet for scientists, such exercises actually play a valuable role in how they learn, think about problems, build knowledge, and disseminate information among themselves and to broader audiences.

Farms as Laboratories: Chemists in Agriculture and the Beginning of Field-Laboratories, 1750-1830

Christopher Halm
Universität Regensburg, Wissenschaftsgeschichte / History of Science

‘The soil is the laboratory in which the food [of the plants] is prepared.’ (Humphry Davy, 1813) In the mid-eighteenth century, chemists started to explore and describe agricultural processes in terms of chemical methods and principles. The utilitarianism of Enlightenment thought in Europe and North America incited these chemists to package their knowledge as both useful and practical, which in turn helped them to gain public recognition and acceptance. To avoid being labeled mere theorists, they had to leave their laboratory buildings to study the farmer’s field. They undertook individual experiments in pots and performed medium-sized cultivation trials in gardens and greenhouses. Some of them, such as Johann Gottschalk Wallerius and William Cullen, carried out trials on their own farms. Others like the instructor Heinrich Einhof at the Agricultural Academy in Möglino, Germany used land owned by educational institutions to pursue their inquiries. Engaging with other like-minded philosophers, big landowners, and farmers in the widespread Republic of Letters, chemists even had different types of plants and soil samples sent to them. These chemists not only brought their view of nature
to bear on agriculture, they also brought chemical instruments and reagents from the laboratory to the field. For example, in 1805 Humphry Davy developed a suitable kit for outdoor soil analyses. Overall, this paper explores how chemists transformed the conception of a field as a place of toil and unpredictable produce to a space of precise and practical chemical inquiry. The farmer’s field had become a viable laboratory.

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**Ferrets Here and There: Global Development of Experimental Practices for Influenza Modelling**

Rachel Ankeny  
*University of Adelaide*

Since at least the 1930s, ferrets have been recognized as extremely well-suited models for studying the pathogenicity and transmissibility of both human and avian influenza viruses. Ferrets are attractive mammalian models due to their relatively small size and other physiological features including the similarity of their lungs to humans, but particularly because they evidence numerous clinical features associated with human disease, especially influenza. Ferrets are highly susceptible to the influenza virus, and have become indispensable for elucidating virus-host interactions following influenza virus infection. However, unlike many other more traditional model organisms such as mice, ferrets are not standardized and often are sourced from diverse types of locales. As a result, standardization occurs via the experimental procedures utilized, via complex negotiations amongst the relatively small community of researchers currently studying them. Using published literature and fieldwork, these processes are explored, with special attention to how practices travel (or fail to do so) between labs, and how arguments are made about the generalizability and applicability of experimental results, given the relative lack of standardization inherent in the experimental system.

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**Fetal Protection Policies in the Industrial Workplace**

Pallavi Podapati

At Johnson Controls, Inc., a car battery manufacturer, the assembly process entailed exposure to high levels of lead. After discovering that six of its female employees became pregnant while maintaining blood lead levels more than those thought safe by the Occupational Safety and Health Administration (OSHA), Johnson, in 1982, barred all its female employees, except those with medically documented infertility, from engaging in tasks that required exposure to lead. Johnson Controls’ decision was rooted in the occupational health practices of the 1950s. In the 1950s automobile manufacturers began instituting their own sex-based labor policies, beginning with a fetal protection policy that prohibited fertile women from working with lead. Neither women nor men in the automobile industry protested these policies in the 1950s. In the next twenty-five years, however, the United Auto Workers (UAW) confronted company fetal protection policies on behalf of their female and male members. The UAW filed the suit against Johnson Controls, which resulted in a 1991 Supreme Court decision disallowing such policies. This paper will examine how fetal protection policies were justified by various parties, how notions of acceptable risks (and for whom) developed and were animated by the growing number of women entering the industrial workforce and the increased medical scrutiny they received. It will also highlight the debates amongst regulatory agencies, employers and the courts that were underpinned by data on the effects of lead on women’s reproductive health but did not account for the effects on men’s reproductive health.

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**Film, Television, and Medium Specificity in Postwar Biomedical Science Education**

Scott Curtis  
*Northwestern University*

A history of science focusing on how different media are deployed to construct and communicate expert knowledge would need to concede that no single medium–writing, imaging, or other types of notation...
or recording—dominates this process. But neither can we expect all media to function similarly. Moving images function differently than still photographs or graphs or the written word. The pressing historiographical questions, then, are: how do these media function? What difference does the choice of medium make to the researcher? These are not questions media scholars often ask with regard to scientific imaging, nor questions historians of science often ask with regard to media; most discussions treat all media as equally transparent conveyers of a message without considering how the formal properties of the medium might affect our interpretation of any message—or the researchers’ own understanding of their object of study. To approach these questions, this presentation will compare the use of film to the use of television in medical schools and scientific laboratories after WWII. Through an examination of archival sources, it will demonstrate that researchers were indeed sensitive to formal properties, such as the density, grain, and clarity of the image, as well as to the different capabilities of the technologies. This paper argues that researchers had their own implicit or explicit theories of medium specificity, which help to explain historical patterns of media use and therefore should heighten our sensitivity to the formal specificity of media in the history of science and medicine.

Finding Gendered Space: Knowledge Production, Practice, and Technology in Swedish Medicine, 1870-1914

Kristin Halverson
Södertörn University

This paper examines gender in the interplay of practice, knowledge production and device in medicine in Sweden between approximately 1870 and 1914 by looking at medical trade catalogues and trade journals. Studying this relationship aims to locate where women are through the examination of technologies and knowledge, and scrutinize the boundaries of gendered space. Exploring changes in surgical practice, such as the growing use of antiseptics and aseptics in relation to the opening of the abdomen, and the proliferation of technological developments in order to accommodate them pinpoints gendered divisions from production-market-user-patient. For example, a Swedish medical trade catalogue from 1890 categorizes instruments under the headings “women’s illnesses” (kvinnosjukdomar) and childbirth, dedicating a great deal of space for them; whereas, other gendered instruments are not categorized as such. Others offer portraits of their staff, women sitting alongside men, some at sales counters, and some in workshops. In journals, they are represented as patients in case studies, or in relation to new practical developments in treating the many illnesses attributed to women. Medical trade catalogues remain an understudied resource, and this study offers new ways of locating women in Swedish medical history beyond examination of pioneers, midwives, and so-called wise women and quacks: studies which have been undertaken by a number of scholars. Locating women in this way lifts not only their presence, but aims to further understand the demarcations of gendered space relating to knowledge production, practice and technology.

Fixing, Seeing: Circulating Canada Balsam in Victorian Microscopy

Meegan Kennedy
Florida State University

With the “spatial turn” (Livingstone and Withers), scholars are examining local contexts and the networks linking scientists’ communities. We study the circulation of texts, scientists, scientific knowledge, and specimens or the raw materials used to produce (for example) drugs or armaments. We know less about the objects underpinning scientific practice. There are exceptions: Lawrence Dritsas’ “technologies of expedition,” Jennifer Tucker and Marta Braun on photography. What of the sourcing and circulation of the objects used in everyday bench work? Some (notebooks) could be found almost anywhere. Others (microscopes) were crafted in metropolitan centers and traveled across the globe. Canada balsam was a staple of every microscopist’s
cabinet, as shown in Wood’s popular book Common Objects of the Microscope (itself a “common object”)—yet it could be harvested in only one region on earth. A resin from the bark of the balsam fir tree, Canada balsam was a staple of Victorian microscopy. It acted as pinhole “penny” lens, fixative, or clarifying agent, enabling and enhancing microscopic vision from street to laboratory. It’s discussed by broadsides and by Buckland (writing for Dickens). But it could only be extracted from a remote region in summer, in labor-intensive work usually conducted by First Nations peoples. A unique element of North-woods culture, a product of the extraction economy, Canada balsam was a “common object,” not easy to use, with rare and valuable qualities. What story did it offer? The same tale as Victorian microscopy: Painstaking labor, the likelihood of error, perhaps a transcendant reward.

Fly Me to the Moon: Science Television and the Popularization of Spaceflight

Ingrid Ockert
Haas Postdoctoral Fellow, Science History Institute

In this talk, I will discuss the research that I’ve conducted as a 2018 NASA/HSS History Fellow on postwar visions of spaceflight on television. My study considers ways to rethink science fictional series (like NBC’s Star Trek) as serious science educational ventures. Understanding the partnerships that brought Star Trek to air, I argue, helps us think through current science communication partnerships.

Forensic Facts and the Presumption of Innocence

Christopher Hamlin
University of Notre Dame

For a quarter century the “Innocence Project” has garnered public attention for using DNA evidence toward the exoneration of persons wrongly convicted of crimes, often by means of forensic techniques that, in light of DNA no longer seem authoritative. And yet DNA collection/interpretation remains a mainstay of fact-making within a forensic science closely tied to policing and prosecutorial institutions. Relying on a survey of programmatic statements in textbooks and similar sources from the eighteenth century onward, this paper explores a broader question of the deployment of science within legal institutions, i.e., was there an intrinsic bias in the forensic science enterprise itself? Did writers see their enterprise mainly as ancillary to the work of prosecution or mainly as the protecting innocent persons from popular prejudice or misleading appearances? While to some degree the answers to such questions reflect the structures of legal systems, they also reflect views about the nature of science, its appropriate organization, and its role in civil society. I shall briefly explore too the translation of those assumptions into procedural maxims, by addressing the tension between empiricism and interpretation evident in such texts.

Frivolous Science? Expertise and Knowledge-making in the Twentieth-century Perfume Industry

Galina Shyndriayeva
University of Tokyo

The case of the twentieth-century perfume industry illustrates the varieties of knowledge developed in the production of materials requiring a high level of both technical and aesthetic expertise. Previous studies, such as those of Geoffrey Jones and Eugenie Briot, have shown the significance of synthetic perfume materials for expanding the market for finished perfumes and fragranced products. However, these have not examined the kinds of contested knowledge and peculiar expertise developed to making novel products appealing to the senses. Integral in my analysis is Steven Shapin’s work on the sciences of subjectivity. He advocated greater appreciation of the role of the senses in ways of knowing, underscoring the commercial heft of the ‘aesthetic industrial complex’, his designation of industrial, academic and government entities reliant on trained aesthetic judgment to understand markets and design products. In my paper, I will examine the knowledge-making practices of firms producing or managing perfumer materials over the middle of the twentieth century,
Britain, Germany and the US. From the cases of W. J. Bush, Schimmel and Arthur D. Little, I argue that a particular form of blended expertise mixing embodied and instrumental knowledge was developed in industrial perfumery. Balancing on one hand the demands of aesthetic sensibility and a luxury product, and on the other, chemical knowledge, industrial production and corporate limitations, twentieth-century perfumery is a prime case for studying science and the boundaries of scientific practice in modern industry.

From Big Theory to Big Data: The Formation of Neuroscience as a Discipline in the U.S., 1960-1990
Youjung Shin
Korea Advanced Institute of Science and Technology

It was no coincidence that the new field of neuroscience began to take shape in the early 1960s at MIT where cybernetics received much attention. This paper examines how the brain-computer metaphor was shared among mathematicians, computer scientists, and electrical engineers in the 1950s, and how it stimulated a biologist, Francis O. Schmitt, who laid the foundation of Neurosciences Research Program (NRP) at MIT in 1962. By analyzing his notes, speeches, and papers, made for not only scientific journals but also religious meetings, I underscore how Schmitt’s desire to develop a big theory for brain studies—something at the level of quantum theory—was reflected in the emergence of neuroscience in the U.S. I also show the effect of the decline of cybernetics in the new field of neuroscience from the mid-1970s. The ambition to unify brain studies through theory gave way to an emphasis on systematic data collection, which resulted in the launch of the U.S. Human Brain Project in the 1990s. From the vantage point of the rise and fall of the brain-computer metaphor, this paper revisits the history of neuroscience coming into its own as big science in the late twentieth century.

From Blindness to Super Recognition: Prosopagnosia and the Politics of Seeing Others
Sharrona Pearl
University of Pennsylvania

Prosopagnosia, or face blindness, was formally recognized in 1947 by German neurologist, Joachim Bodamer, though reports of the condition date to the nineteenth century. More recently however,
neurologists have begun to view the condition as a spectrum, arguing that if those with total face blindness are on one end, there is also an extreme condition of super recognition. The notion of super recognition has captured the public imagination following a 2016 article in The New Yorker magazine that explored the use of super recognizers to track down criminals using England’s CCTV system. While a number of scholars have begun to examine the history of prosopagnosia, led by the work of Oliver Sacks, rather less attention has been paid to the implications of face blindness in terms of developing other recognition and perception mechanisms. This presentation builds on the provocation of Jenny Edkins to reframe prosopagnosia within the context of disability studies as a different kind of super recognition that trains people to pick up on voice, gait, and expression. I explore the history of prosopagnosia and its diagnostic procedures to examine the ways in which face blind people makes sense of others through alternative cues. Through this work, I propose a humanistic model for the study of the brain and facial recognition; by studying people with face blindness and superrecognition and how they relate to others, we can learn more about the brain itself.

From Light Quanta to Bosons: Conceptual Foundations and Interpretive Flexibility

Daniela Monaldi
York University, Canada

When the Bose-Einstein and the Fermi-Dirac statistics were first formulated and explored, their conceptual foundations raised more questions than the formal apparatus of the theories could answer. The interpretive flexibility of the theories, however, did not deter physicists from probing their applicability to various physical systems and integrating them into networks of practice. It was only in the following two decades, through the tumultuous developments of the 1930s and early 1940s, that a unified interpretation was formulated, which viewed both quantum statistics as consequences of a radical break from the classical conception of radiation and matter. After a brief survey of the interpretative diversity of the early period (1924-1926), some reformulations and uses of the quantum statistics in the 1927-1946 period, for example by George Uhlenbeck, Ralph Fowler, Fritz London, Erwin Schrödinger, and Paul Dirac, are examined, with a focus on the role played by local contexts and traditions of theoretical practice in the eventual emergence of the new foundational categories of “bosons” and “fermions”.

From Matter to Materiality: Premodern Quests for Knowing the Principle of Corporeality

Nicola Polloni
Institut für Philosophie, Humboldt Universität zu Berlin

For a premodern scientist, matter is what made an apple this apple and also distinguished that apple from the mental idea. Matter was the carrier of three-dimensional extension and the bearer of forms, which in turn articulated the patterns of definition, shape, and intrinsic nature of this or any apple. Premodern knowing depended on form whence matter appears to inevitably escape it–as matter is, by definition, what is other than form. How was the premodern understanding of corporeality shaped by the grounding and yet shadowy functions by matter? And how could premodern thinkers grasp what matter is—and subsequently how it can properly satisfy the physical conditions of dimensionality and corporeality—if matter cannot be known? This paper will examine two alternative strategies that were put in place to resolve this puzzle in the High Middle Ages: the denial that knowing matter is possible (Aquinas) and the assumption that it can be known albeit feebly and mediatedly (Scotus and Ockham). While both strategies meant to resolve this puzzle, they also contributed to stress the theoretical flaws which originated by the tension between the physical functions of matter and its (un)knowability. This crucial impasse would facilitate the identification of matter and materiality, as it required philosophers and scientists to provide new answers and narratives
beyond the Aristotelian tradition and to drastically contribute to the final ousting of Aristotelian metaphysics from natural science.

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**From the Fields of India to the Factories of England: Helenus Scott, James Keir, and the Case of the Indian Alkali**

Kristen Schranz  
*University of Toronto*

In the 1780s and 1790s, the East India Company surgeon Helenus Scott sent specimens of Indian alkali from Bombay to England. He had observed the local population procuring the substance from brown earth and making it into soap. Recognizing Britain’s need for alkali in the arts, Scott petitioned the Court of Directors of the East India Company to bring the material to England. What was useful in the fields of India, however, was not guaranteed to be beneficial in the factories of England. Contacting the Society for the Encouragement of Arts, Manufactures and Commerce, Scott incited trials by British chemists and manufacturers who confirmed the potential utility of the Indian alkali. From his chemical manufactory, James Keir reported on the strength and purity of the material as ideal for local plate glass and hard soap. Nevertheless, Keir tempered his optimism by saying that most English manufacturers were wary of new raw materials that might injure their products. This paper teases out the complexities of ‘translating’ a material across geographic regions by acknowledging the cosmopolitan yet local nature of Indian alkali. It is also a narrative that contributes to our understanding of Europe’s ‘Industrial Enlightenment’, which involved engagement with products and processes from India. Scott contrasted the ‘experience of India’ with the ‘science of Europe’, but both labels signify equally important ways of knowing. The case of Scott’s alkali also emphasizes the governing role of institutions in circulating useful substances from East to West.

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**Games and Genes: Cytogenetics Meets Human Diversity, Mexico 1968**

Ana Barahona  
*Evolutionary Biology*

The first time that cytogenetic techniques were applied to athletes was in the 1966 European Championship in Budapest, and for the first time to Olympic athletes in the 1968 Olympic Games in Mexico City. For this purpose, in 1966 the Genetics and Human Biology Program was created in close collaboration with the Local Olympic Organizing Committee. Although Mexican geneticist Alfonso León de Garay led the project, the head of the Program was Mexican geneticist Rodolfo Félix Estrada. The main objective of the Program was to study the genetic and anthropological components which determine an Olympic athlete’s abilities. This investigation included 1,265 games participants and covered family studies, cytological investigations, research on single genes, and analysis of finger and palm prints. The studies were carried out by independent teams, working in close collaboration with each other: the karyotyping technique used was that of Barbara Honeyman Heath and Lindsay Carter, both of whom carried out most of the work along with Johanna Faulhaber and Mexican geneticists Olga Olvera and Rosario Rodríguez. Another team headed by physician Alejo Romero studied the distribution of blood groups; biologists María Teresa García and Virginia Tiburcio carried out the study on genetic markers associated with enzymatic factors and sensitivity to phenylthiocarbamide. Other personnel participated with Ursula Mittwoch of the Galton Laboratory in the sex determination of the athletes using sexual chromatin and buccal smear tests. In terms of influence beyond Mexico, this project was very important as a site of transnational collaboration.

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**General Marsili’s Mediterranean: Reframing Ocean Science in Early Modern Europe**

Tamara Caulkins  
*Oregon State University*

The scientific exploration of the sea in the early modern period was closely tied to military concerns as nations jostled to gain and maintain maritime
hegemony and as captains armed their ships against pirates on the high seas. During this time, most of what was known about the sea had to do with navigating the surface of the oceans or with understanding life in the seas—i.e. resources such as whale oil or fish—rather than the sea itself. Count Luigi Ferdinando Marsili (1658-1730), a military general turned “virtuoso” naturalist, was one of the few investigators who focused his scientific inquiry on ocean geography and its plants. In his Histoire Physique de la Mer [Physical History of the Sea] published in Amsterdam in 1725, Marsili discussed the geography of the ocean basin, the composition of salt water, his measurements of currents, and a variety of marine plants. Marsili’s oceanographic work was deeply informed by his career as an officer in the Hapsburg army. Drawing on my research on eighteenth-century military drill diagrams, I will discuss graphic conventions in Marsili’s publication which were connected to Enlightenment understandings of the natural world and to the reshaping of society.

Gentlemanly Journals amidst the Growth of Science: How the Royal Society’s Publishing Division Coped, c.1900-1965

Aileen Fyfe
University of St Andrews

By the twentieth century, the Royal Society was an experienced publisher of scientific journals: the Philosophical Transactions had been founded in 1665, while the Proceedings was created in 1831. But the Society’s traditionally generous and gentlemanly approach to publishing had already become difficult to sustain by the 1890s. In this paper, I will investigate how the Society and its journals weathered the challenges of the twentieth century. These can largely be seen as deriving from the expansion of scientific research. During the first four decades, the key issues were editorial and financial: the rising number of papers being submitted meant more editorial labour to be done, and more paper, printing and illustrations to be paid for. After the Second World War, the new wave of journals issued by commercial publishers (e.g. Pergamon) brought worries about the ongoing role of society-publishing, as well as a possible new financial model for journal publishing. The Royal Society made certain changes in the 1960s which partially solved the editorial and reputational challenges facing its journals; but its clearest success lay in the notion of ‘self-help for learned journals’ (1963), which solved its financial problems for the medium term. These changes form part of the story of how scientific journals evolved from records of the research of gentlemanly scholars into the tools that make both knowledge and careers in the modern academic profession.

German Approaches to Disability in 20th Century America

Katherine Sorrels
University of Cincinnati

In the winter of 1938, a group of Jewish doctors and therapists fled Vienna, reassembled in northern Scotland, and founded an intentional community for the care of children with disabilities called Camphill Special School. In an era when shame, blame, and institutionalization were the response to disability, they founded Camphill on the principle that disabled children could enrich communities and that doctors should abandon the search for cures. Their radical position was rooted in their unusual approach to medicine. They were followers of the Austrian occult philosopher, Rudolf Steiner, whose philosophy, called Anthroposophy, spawned alternative medical, educational, and agricultural movements. In spite of these unorthodox credentials, Camphill soon grew into an international movement; there are over 100 communities around the world today. Though the Camphill movement is now headquartered in the US, I argue that its roots as a Central European medical subculture remain definitive today. The movement originated in the era of eugenics and as Douglas Baynton has noted, eugenicist concerns about disability were inseparable from concerns about race. In fact, German racial thinking structured the founders’ thinking about ability and disability. I use
writings by the founders and oral history interviews with older community members to reconstruct and analyze Camphill’s unusual approach to disability. In the process, I shed light on current historiographic discussions about the roots of the disability rights movement and the ways in which countercultural thinkers, movements, and communities have forged diverse and sometimes uncomfortable alliances among people with common concerns about health.


*Alexander Aylward  
University of Leeds*

Increasingly, historians of biology are paying attention to the various ‘personal syntheses’ achieved in the early to mid-twentieth century. This period, which has traditionally been viewed as one of synthesis, is becoming one of many syntheses, as we ask how individual evolutionists brought together and negotiated the assorted scientific, conceptual, practical and other resources at their disposal. The present paper explores a case in which these two perspectives intersect. The synthesis in evolutionary studies, traditionally conceived, amounted to a reconciliation of Darwin’s theory of natural selection with the burgeoning field of Mendelian genetics. In accounts of this synthesis, Ronald Aylmer Fisher (1890-1962) routinely takes centre-stage. His celebrated paper of 1918 represents for many the first successful attempt to mathematically reconcile Darwinism and Mendelism. At other times, historians speak of this theoretical synthesis as the achievement, somewhat paradoxically, of a whole community of researchers. This paper, then, grapples with questions as to the nature of the evolutionary synthesis, and to whom (if anyone) it belonged. By way of disentangling the above difficulty, and with reference to correspondence and new archival material, this paper follows Fisher through the formative years between his student days on the Mathematical Tripos at Cambridge in the 1910s, and the publication in 1930 of his lastingly influential Genetical Theory of Natural Selection. In particular, I ask: how did Fisher synthesise Darwinian selectionism and Mendelian genetics? From which resources did he gain his knowledge of each? Why did he set himself this synthesising task?

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**Girls Heart STEM: The Wildly-Accelerating Movement to Draw Young Women Into STEM, 1965-Today**

*Amy Bix  
Iowa State University*

This paper analyzes one of the most distinctive developments in science and engineering from 1965 to the present, the emergence of high-visibility campaigns to improve scientific and technical education for a broader range of young people. It details how, when, and why diversity grew into a priority for STEM access, permanently reshaping our modern cultures of science, engineering, education, and child-rearing. Analysis here focuses on evolution of STEM campaigns for girls, but offers insight into parallel histories promoting access for other under-represented groups.

Fifty years ago, many ridiculed or dismissed any idea of women handling the toughest scientific subjects, associating intellectual progress with white masculinity. But over five decades, colleges, K-12 educators, museums, and non-profits devoted increasing effort to local/national/international girls’ STEM programs. Today, political leaders, corporations, and major organizations join science organizations, celebrities, parents, and volunteers in supporting science camps, books, toys, television shows, websites, all encouraging girls to pursue STEM.

Despite the scope and significance of this revolution in both professional and popular ideas about who can and should enter STEM, we have no systematic exploration yet of how this dramatic shift happened. The story is complex, both reflecting and driving changes in gender relations, plus escalating concern for girls’ psychological well-being and personal opportunities. Diversity discussions both reflected and
Glands and Hormones: 20th Century Hopes and Fears across the Northern Hemisphere

Tabea Cornel
University of Pennsylvania

Research on glandular secretions and their metabolic impact transfigured the medico-scientific understanding of the body in the late 19th century. In 1905, British physiologist Ernest H. Starling (1866-1927) coined the word “hormone,” an umbrella term for secretions from various parts of the body. In the subsequent decades, glandular science flourished and fueled a refashioning of concepts such as aging, growth, reproduction, and sex/gender. This panel sheds light on various ways in which the hormonal view of the body impacted 20th-century science in Asia, Europe, and North America. What role did glands and hormones fulfill in scientific and social lives at different times and places? What hopes and fears were associated with interfering in the hormonal body? To what extent were hormone-related practices and theories mobile across space and time? The papers exemplify multiple connotations of hormones: they could be both promises and threats to human health, as well as disruptors or justifications of the contemporary social order. Furthermore, due to the double role of hormones as actively sexing/gendering (through their metabolic function) and passively sexed/gendered substances (through social ascriptions), hormonal theories and practices transcended the binaries between nature and nurture, and between the physical and the social world.

Global Empire, Jesuit Networks, and the Deniable Body: Nature and Disease in Colonial Brazil, 1549-1565

Hugh Cagle
University of Utah

Portugal’s Atlantic empire had a way of ignoring Brazilian nature and of making some bodies more evidentiary than others. In an age in which the South American landscape was said to brim with all manner of mirabilia and in which many metropolitan naturalists eagerly sought novelties from abroad, not one naturalist from sixteenth-century Portugal travelled to Brazil to catalogue its nature and scour it for wonders. Meanwhile, in the face of widely circulated, lurid, and pained accounts of rampant disease beginning almost as soon as concerted colonization got underway in 1549, generations of Portuguese observers continued to tout the health of
Portugal’s South American colonies. In this paper, I argue that the Society of Jesus helped inaugurate both of these patterns. If, as most modern historians suggest, the Jesuits were advocates of the careful, disciplined study of natural phenomena, I argue that for the mid-sixteenth century that view is at best anachronistic. I show that the first generation of Jesuits in Portuguese America encouraged both a learned ignorance of Brazilian nature and a tendency among colonial contemporaries to dismiss the bodily manifestations of epidemic disease. I show how Jesuit accounts of both nature and disease grew out of debates within the Society over the allocation of personnel and expertise—at a time when the order itself was still relatively new, poor, vulnerable, and vying for patronage and authority.


James Lin
University of Washington

In 1968, Taiwanese planners began to consider how to market their considerable expertise in agricultural science, accumulated after decades of success at increasing agricultural yields and raising daily caloric intake. At the same time, the rise of the Green Revolution placed high-yield crop cultivars front and center globally, starting with wheat and maize, followed by miracle rice. Taiwanese scientists in 1971 and 1972, in conjunction with US Agency for International Development and Rockefeller Foundation officials, founded several international scientific research institutes built along similar lines: the Asian Vegetable Research and Development Center (AVRDC) and the Food and Fertilizer Technology Center (FFTC), to disseminate Taiwanese vegetables such as broccoli rabe to other subtropical, Global South societies.

This paper discusses the rise of international science networks as centered on agricultural research institutions, and how they embodied changing scientific ideas of agriculture and nutrition. It argues that scientific networks and research institutions were shaped by political headwinds: the expulsion of Taiwan (The Republic of China) from the United Nations and the shifting importance to the Global South; the increasing global attention to humanitarian issues of poverty and hunger; and the politics of nutritional science that shifted from calories to minerals and vitamins. Taiwan attempted to position itself at the vanguard of these trends by leveraging their scientific expertise. Although "modern science" sometimes proved a powerful ideological tool, Taiwan in the 1970s and 80s was ultimately unable to utilize science to transcend politics.

Going Wild: Disease and Wildlife in Mid-Twentieth Century America

Katie Sullivan-Thomas
Mississippi State University

An outbreak of encephalitis in 1938 Massachusetts sent health officials scrambling to find a way to explain the epidemic. Upon the deaths of eight children, brain matter from an infected child was used to inoculate horses, resulting in the confirmation of a distinct disease that could infect both humans and horses; researchers called it “eastern equine encephalomyelitis,” or EEE. Throughout the 1940s and 1950s, veterinarians, biologists, and other experimental scientists worked to uncover the disease’s transmission network, which directly related to the victims’ environment. Pastured animals and humans living close to or visiting wild areas seemed to be at the greatest risk for infection. With the creation of an effective vaccine that could prevent the disease in horses and an emergent understanding of how to prevent human exposure, EEE increasingly became associated with wildlife, only dangerous if it escaped its natural habitat to invade human society. Using veterinary textbooks, agricultural manuals, and other scholarly publications, this paper investigates how animal vaccines were used in mid-20th century America to form a protective barrier between humans and wildlife diseases. This immunological barrier, I
argue, served as a cultural boundary between wild and domestic spaces. In a period of increasing environmental awareness and concentrated efforts to seek interaction with natural spaces, the “wild” was both a place worthy of protection and a lingering threat to human health. Vaccines enabled people to come into more frequent contact with these spaces, manipulating certain animal bodies while drawing margins around human spaces and “wild” ones.

Hans Bethe, Nuclear Model

Benjamin Wilson
Harvard University

In a version of history told by Hans Bethe, scientists in the nuclear age had a dual obligation to serve the state and to inform the public about government policy, especially when policy had become unwise or dangerous. Bethe himself seemed to model these principles. A leader on the Manhattan Project, he had supported the international control of atomic energy and a nuclear test ban in the postwar years. This paper revisits historical memory of the social responsibility of science, using Bethe’s Cold War engagement with the issue of ballistic missile defense as a study of the mismatch between memory and reality. In the late 1960s, Bethe solidified his reputation as an outspoken insider critic when he published a detailed critique (with fellow physicist Richard Garwin) of the proposed U.S. Anti-Ballistic Missile system. What historians have never discussed, however, is the fact that while Bethe counseled nuclear restraint on prominent advisory positions and in public, he quietly worked as a highly paid consultant to industrial contractors designing and developing the system (as well as on countermeasures to overcome missile defense). Bethe pursued incongruous private and public roles that seemed to present, for him, no apparent contradiction. The paper explores the relationship and tensions between Bethe’s classified work and the maintenance of his public image.

Harmonious Philosophy: The Place of Sound in British Science, 1830-1840

Edward Gillin
University of Cambridge

The romantic idea that music and the universe were somehow interlinked is an ancient one, going back to the Pythagorean conception of the ‘music of the
spheres’. Though not new to the nineteenth century, such imaginative comparisons took on increasing significance during the 1830s and 1840s, especially in Britain, where visions of a harmonious universe, governed by a few divinely-ordained laws, provided an important counterweight to political radicalism and theological materialism. The links between the study of light and sound have been well explored, notably Thomas Young’s experimental inquiries, but by the mid-nineteenth century, the investigation of sound was inseparable from the broader examination of natural phenomena; especially the invisible forces of heat, light, electricity, and magnetism. My paper focuses on the writings of William Whewell, Mary Somerville, and John Herschel to explore how sound, and specifically music, provided crucial evidence to support their interpretations of nature. Each of these three authors, probably the leading British science writers of their day, was eager to project their image of a harmonious, connected universe, brought about by a benevolent Creator. While Herschel and Whewell both conceived of sound as evidence of the unity of nature, Somerville conceived of the universe as a finely-tuned organ. Within the context of political uncertainty, religious controversy, and social instability, ideals of a harmonious universe became urgent.

Harold N. Fisk’s (1944) Maps of the Meandering Mississippi River

David Spanagel
Worcester Polytechnic Institute

In the spring of 1941, the United States Army Corps of Engineers authorized an ambitious geological investigation of the alluvial valley of lower Mississippi. This project would occupy the Mississippi River Commission for the next three and a half years, and its final report would showcase the remarkable analytic and cartographic talents of Louisiana State University geology professor Harold Norman Fisk (1908-1964). This paper traces the impact of Fisk’s meander maps on a wide array of scientific and cultural domains. Beyond geology and engineering, where Fisk’s achievement was widely recognized, I examine how these maps have stimulated other scientific, humanistic, and cultural interpretations of the Mississippi River’s past. Archaeologists, for example, used Fisk’s periodization of the river’s various channel stages as a key technical tool for identifying the most likely locations where Amerindian and European artifacts might link to historical events. Now we come full circle, from historical applications, to esthetics, and back to science. Geomorphologists have long assumed that the sedimentary legacies of environmental change are indistinguishable from those from tectonic influences. In the context of recent attention to anthropogenic climate change, however, Fisk’s maps provide an exquisite basis for closer study of climate factors in river system dynamism.

Hermann von Helmholtz on the Meaning Of Quantity, in Relation to Electromagnetic Measurement and Standardization

Biying Ling
University of Chicago

Abstract: Addressing the perennial question “under what conditions can real objects, attributes or relations be represented by numbers?” Hermann von Helmholtz gave an answer in his 1887 lecture “Zählen und Messen” which diverged from the predominant Kantian understanding of quantity and number. Unlike Kant, Helmholtz defined numbers prior to quantities, and regarded the concepts of homogeneity, unit, equality and addition as not having to do with necessary stages of human cognition, but physically determined in specific experimental contexts. Furthermore, Helmholtz did not define measurability by reference to measurement of space, time and mass, which made his views different from his contemporaries, such as the neo-Kantian philosopher Hermann Cohen, the mathematician Paul Du Bois Reymond and the physicist James Clerk Maxwell. The current paper argues that Helmholtz’s epistemology in “Zählen und Messen” closely mirrored the practices of measurement in electricity and magnetism, and was
shaped by his involvement in efforts to establish an international electrical standard leading up to the 1881 International Congress of Electricians. The divergence between practice and theory, the lengthy process of calibration leading up to the definition and manufacture of units, and the ambiguous role of the measurement of length, mass and time in defining electromagnetic standards, all played a part in Helmholtz's 1887 article.

**Heroism on Ice, 25 Years**

Dani Inkpen
Harvard University

Twenty-five years ago, Lisa Bloom’s "Gender on Ice" (1993) drew historians’ attention to the ideologies of masculinism and nationalism operating in historical discourses of polar exploration and science. Key to Bloom’s intervention was an analysis of the white, masculine heroism performed and embodied by men such as Robert Peary and Frederick Cook. Since "Gender on Ice," critiques of white, male heroics have become common in histories of the field sciences. Historians have analyzed various ways that ideologies of heroism enabled certain knowers and excluded others. This talk examines dominant notions of heroism in the historiography of alpine and polar science. Specifically, the belief that heroism is primarily exclusionary to female scientists and antithetical to feminist science. I ask two critical questions: Have historians unwittingly adopted a definition of heroism specific to a particular set of historical actors and allowed that to stand for heroism in other historical contexts? What might this mean for the stories we tell (and don’t tell) about polar and alpine field science? I explore these questions and alternative possibilities through telling stories of the mountain explorers and botanists Mary Schäffer Warren (1861-1939) and Mary Vaux Walcott (1860-1940). In doing so, I seek a model for a female hero of alpine science, outlining both her laudable and the objectionable traits, and thereby re-examine dominant historiographical accounts of heroism.

**Hormonal Fillings for Epistemic Gaps: Testosterone as a Bridge between Incoherent Concepts of ‘the Brain’**

Tabea Cornel
University of Pennsylvania

In the 1980s, three neurologists from Boston and Glasgow proposed that brain laterality and numerous human ‘abnormalities’ might have a shared hormonal cause. Norman Geschwind (1926-1984) and colleagues suggested that fetal testosterone regulates brain asymmetry and impacts other characteristics including hand preference, sexual orientation, mental abilities, the immune system, and the susceptibility to psychiatric illness. The neurologists produced no experimental data to back their hypothesis. They primarily based their model on a review of hundreds of publications from a wide range of times, places, and disciplines. My paper illustrates that the neurologists mobilized incoherent concepts of ‘the brain’ by drawing on such a variety of scholarly literature. The reviewed works promoted anatomical, hormonal, or genetic understandings of ‘the brain’, and each of these epistemic versions of ‘the brain’ had been assessed with distinct methods, ranging from lesion studies through questionnaires to behavioral observation. Geschwind and colleagues glossed over these substantial conceptual differences in their attempt to distill the heterogeneous literature into a grand unified theory of human life. Drawing from archival collections, published records, and oral history interviews, I show that the epistemic multiplicity of ‘the brain’ led to a tension between concepts of fixity (‘nature’) and plasticity (‘nurture’) in the neurologists’ understanding of the human. I argue that Geschwind and colleagues depended on testosterone to bridge these epistemic divides. Conceiving of this hormone as genetically regulated with anatomically localizable effects, the neurologists combined concepts of fixity and plasticity in a model that essentialized human character and behavior.

**How Comparative Psychology Lost its Soul: Psychical Research and Animal Minds, 1898-1920**

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By the 1920s, comparative psychology would have hardly been recognizable to the naturalists who had filled its ranks a generation prior. In fewer than thirty years, it had transitioned from an area dominated by field observations, case studies, and at-home experiments to one consisting of lab work, repeated trials, and specialized instrumentation. Where notions like “reason,” “play,” and even “criminality” in animals had once been freely discussed, they were now looked upon with the greatest skepticism. In fact, there was a sense in which the object of study itself had changed. Whereas earlier texts bore names like Mind in Animals and The Psychic Life of Micro-Organisms, later authors frequently opted for titles like Studies in Animal Behavior or simply Behavior. The reasons for this change are not especially well-understood. However, I argue that much of the shift can be explained as a reaction to contemporary anxieties concerning the close relationship between psychology and psychical research (i.e., the investigation of telepathy and other supernormal phenomena). Focusing on the experimental programme advanced by figures like Edward Thorndike and J.B. Watson between 1898 and 1920, I show how developments in psychical research and the concerns these raised about the proper objects and methods of psychology were used to push for greater conservatism in the study of animals. I consider how this approach was promoted by leading opponents of psychical research and incorporated into the training of later psychologists, cementing its position for generations to come.

How Liberal Protestants Bought White’s Conflict Thesis and Lost Their Faith

Edward Davis
Messiah College

In the United States during the early twentieth century, liberal Protestant scientists and theologians were heavily influenced by Andrew Dickson White’s conflict thesis. Owing to White’s famous two-volume book, A History of the Warfare of Science with Theology in Christendom (1896), they did not believe that traditional Christian theology had ever had a productive conversation with science, and they agreed with White that the route to progress involved leaving orthodox beliefs behind. This paper briefly reviews White’s version of the history of Christianity and science and shows how White shaped the attitudes and ideas of several major Protestant scientists and theologians prior to World War Two, most of whom were also leading public intellectuals: Edwin Grant Conklin, Harry Emerson Fosdick, Shailer Mathews, Samuel Christian Schmucker, and Gerald Birney Smith.

How the Modern Synthesis Came to Ecology

Philippe Huneman
IHPST CNRS Paris

Ecology is in principle tied to evolution, since communities and ecosystems result from evolution, while ecological conditions in turn determine fitness values, hence evolution. Yet, as disciplines, evolution and ecology were not unified along the 20th century. The Modern Synthesis intended to invest ecology, but its major ideas, namely the primacy of selection and the key role of gene frequencies, did not directly translate into ecology. However, the architects of the Modern Synthesis, starting with Huxley who mentored Elton, constantly pushed for such integration, like Fisher who supported Ford’s ‘ecological genetics’, or Mayr’s supporting Lack’s views on clutch-size during debates on density-dependent regulation of populations. I’ll consider four stages through which the MS got integrated into ecology, and distinguish between various ways in which a possible integration was gained, focusing on the way the questions of population regulation and of species coexistence (or diversity) were two successive crucial issues through which the Synthesis’ key ideas were brought in contact with diverse families of ecologists. Starting with Elton’s animal ecology (1927), I consider successively Ford’s ecological genetics in the 1940s, the textbook Principles of
animal ecology edited by Allee and colleagues (1949) as the expression of a sort of Clements-Wright synthesis, and then the debates over the role of competition in population regulation in the 1950s, ending with Hutchinson’s formulating the niche concept as both a solution to the density-dependence debate, and an overture towards group-selection-free approach to the coexistence question. I’ll emphasise throughout this story the involvement of Synthesis architects

How X-Rays Changed the Practice of Art History

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Despite earlier experimentation with X-Ray technology applied to paintings in German science laboratories, it was only in the 1920s and 1930s that the technology became more widely and systematically applied to art. Alan Burrough’s acquisition of the first and extensive archive of X-ray images of paintings, first of the Fogg Art Museum in Cambridge, Massachusetts, was the most important driving force behind this. Burrough’s efforts were inspirational for Kurt Wehlte, the German Maltechniker, who in the 1930s established a laboratory for the X-Ray investigation of paintings in Berlin. In this paper I discuss how and in which ways X-ray investigations of paintings were consequential for art history. To this end, I look at the work of two other researchers: Christian Wolters in Munich and Berlin; and Martin de Wild in Delft and Utrecht. The history of X-ray technology in the history of art in the 1920s and 1930s shows that it was not simply a matter of art versus science, that is, of the eager adoption by scientists embarking on the art historical terrain from their recently established museum laboratories versus the outright rejection of the technology in circles of artists and humanists. X-ray technology was accepted when it supported a particular style of art history which was structured around formal analysis and which radiating from Vienna made school across Germany and the Netherlands. These art historians maintained that new ways of scientifically examining art in the laboratory required students of art history to learn new ways of seeing.

Human Capitalists: Valuing Lives in the Slave South

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In 1856, twelve babies were born on Canebrake Plantation in Adams County, Mississippi: six boys and six girls. The first, Kate, arrived on January 21, born to Beck, age thirty. The last came just before the New Year–Jenny, born to Susan, age twenty-three, on December 29. One, a baby girl born to Peggy on November 12, did not survive the month. If she received a name, we do not know it. But the rest lived long enough to be entered into an inventory of lives. There, Canebrake’s proprietor, James Green Carson, noted their names, ages, and values. He priced each baby at $25 except for Kate. He rounded her age up to one and set her value at $75. Thus, the births of 1856 became $325 in human capital at the beginning of 1857. Many years before he would begin to measure their labor, Carson had already entered them into his account books as capital.

Slaves were, quite literally, human capital, and their value could appreciate through maturation, reproduction, and health or depreciate through illness, age, and disobedience. This paper examines the different ways slaveholders sought to estimate their value. Planters used both the language and logic of “depreciation” decades before it would become a common accounting technique, and traders and auctioneers graded enslaved people into standard categories with standard prices. Though slaveholders’ calculations suggested that prices were efficient and correct, beneath their rationalizing patina was the fundamental reality that property was political—especially property in people.

Imagined Community, Parent Memoirs, and the Construction of Autism and Down Syndrome
In 1967, Clara Claiborne Park published The Siege: The First Eight Years of an Autistic Child, her memoir tracing the experiences of symptoms, diagnosis, treatments, uncertainty, and advocacy that became the dominant narrative of parenting a child with autism. The Siege initiated the genre of parent memoirs of autistic children, building upon an existing literature of parent memoirs of children with disabilities, most notably Down syndrome. For autism and Down syndrome, parent memoirs served as a site for the construction of imagined communities of the afflicted, using the imagery and narratives that parents created in these works to shape the meaning of these disorders along with the identity of parents as caretakers, advocates, and experts on behalf of their children.

Using parent memoirs along with medical literature, archival research, and oral history, this paper will argue that the imagined community surrounding autism used parent memoirs to construct the disorder in opposition to Down syndrome, shaping autism’s ability to replace Down syndrome as the paradigmatic childhood disability of note. The tropes of the autism spectrum as established and reified by parent memoirs capitalized on the opportunities for autism’s ascendance offered by changing diagnostic criteria, medical research, and cultural controversies surrounding the disorder. Despite the increasing prevalence and improved life expectancy of individuals with Down syndrome since the 1970s, the genre of memoirs of Down syndrome has not produced a similarly useful meaning of the syndrome to maintain its cultural prominence.

Insects created challenges for Napoleon’s administration, French awareness of these threats differed markedly. While locust infestations posed an evident danger to grain harvests, scientists had not yet identified the role of the mosquito as a vector for malaria. These cases thus present an opportunity to examine the ways in which the presence or absence of scientific knowledge can shape human relationships with other species. In the case of the mosquito, ignorance of the connection between insects and disease caused French officials to vacillate between proposed solutions. By contrast, French officials engaged in a deliberate campaign to eradicate locust populations. Yet ironically, while the direct effort against locusts achieved only partial success, French experts examining the problem of malaria advanced strategies of environmental transformation that would prove increasingly successful in eradicating the disease in the years to come. These contrasting outcomes illuminate the complex ways in which animal agency interacts with science and state power to shape historical events. Although it is important to recognize the power of insects to “speak” through their influence in human history, it is equally necessary to understand the impact of animal “silence” as constituted through human ignorance. Likewise, while modern government has often sought to make the environment more “legible,” state projects are often profoundly influenced by a complex array

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*Imperial Wires: Afghanistan’s Resistance to the Telegraph*

Elham Bakhtary  
*George Washington University*

The nineteenth-century communications revolution witnessed Islamic rulers eagerly adopt new technologies en masse. A curious outlier to this was the Afghan ruler Amir Sher Ali (r. 1863-78). Rather than adopt the communications revolution in toto, he adopted the postal system, printing press, and photography, but left out the telegraph. Existing scholarship offers little in the way of explaining this.
Historians of nineteenth-century Afghanistan have yet to approach questions of technology due to their consensus that Afghanistan was an isolated backwater. Additionally, historians of the telegraph have only focused on countries that possessed the technology, explaining away those that did not as having lacked access or interest.

My research, however, demonstrates that the absence of telegraphy from Afghanistan was not a question of access or desire. In fact, Amir Sher Ali had offers from both British and Russian officials to have a telegraph network built free of charge. Additionally, the Amir exhibited strong interest in the abilities of the telegraph. This paper argues then that the Amir’s decision to not adopt telegraphy stemmed from its interconnectedness with the spread of British and Russian imperialism. Incorporation into a European telegraphic network was seen as an omen of imminent colonial rule. Furthermore, telegraphy would eliminate the communicative delay tactics the Amir employed in order to contain the ever-increasing European demands made to undermine his sovereignty. Thus, this paper allows us to examine the political strings attached to technology and better understand why some technologies floundered in certain contexts more than others.

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**India and China and the Exchange of Medical Knowledge in Antiquity**

Sean Bradley

*University of Washington*

While Ayurveda and Traditional Chinese Medicine represent two very distinct practices of medicine, thousands of years of cultural and economic exchange have led to numerous exchanges and overlap of theory, treatment modalities, and use of pharmacological substances. By looking closely at this exchange of medicine, we can examine how trade and cultural contact influenced the use of medicine and its practice. Linguistic correlation, language reconstruction, geographic distribution of plants, received and discovered medical texts, exploration of primary sources in Sanskrit and Classical Chinese will be used to create a clearer picture of the exchange of medicines in Antiquity and provide greater understanding of how these two ancient practices developed into the systems used today.

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**In Search of the “Secrets of the Old Masters”: Early Analytical Approaches to the Characterization of Traditional Easel Paintings**

Kristin DeGhetaldi

*University of Delaware*

Throughout the 1930s, 40s, and 50s, scientists and conservators at a select number of cultural institutions worked towards developing a more accurate understanding of the techniques and materials used by Old Master painters. Some of the first pioneers in this area include A.P. Laurie based in Edinburgh, Max Doerner and Alexander Eibner at the Deorner Institut in Munich, Rutherford Gettens together with George Stout and David Thompson at Harvard University’s Fogg Art Museum, Paul Coremans at the Royal Institute for Cultural Heritage in Brussels, and Joyce Plesters at the National Gallery in London. Early accounts describe spot or “wiping” tests, heating/burning tests, and microchemical tests performed on samples or on the actual artworks themselves. In addition, this period witnessed a marked improvement on the methods used to both extract and preserve paint samples, ultimately culminating in procedures used to prepare intact cross-sectional samples, methods that are still used to this day by the conservation community. This talk will outline the evolution of these tests and how they were very much influenced by international collaborations and current art historical debates; nearly all of these early initiatives were driven by two primary questions: 1) how did the transition from egg to oil manifest during the early Italian Renaissance and 2) what was the chosen medium of Jan van Eyck and his workshop? Based on the outcome of these early tests, scientists and conservators were able to draw certain conclusions and theories, many of which will be discussed during this paper.
Indigenous and Environmental Knowledges in Translation

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Scientific knowledge is customarily understood as a product of value-neutral observation, and its transmission as a straightforward process of diffusion. In recent years, historians of science have come increasingly to recognize the creation and communication of science as invariably complex processes of translation. Translations represent inventive adaptations and appropriations of languages, cultures, and non-human elements of nature. They embody diminutions as well as augmentations of untranslated originals, and can be material or conceptual, coercive as well as subversive. Inequalities and violences engendered by colonialism bring the stakes of translation into especially sharp relief. Our session brings together five case studies in colonial scientific translation: Puerto Rican indigenous expertise rendered as colonial archaeology and reshaped as a Taíno-led nationalist enterprise; settler agricultural “improvement” experienced by Omaha people as colonial impairment; Philippine indigenous botanical and environmental knowledge mobilized to serve shifting colonial economic, anthropological and botanical objectives; Diné vocabulary adapted to encompass concepts of radioactivity and nuclear contamination; and indigenous women’s botanical knowledge masculinized by agricultural technology in the name of food sovereignty. Scientific stories have frequently worked to marginalize indigenous cultures in the service of colonizing environmental and cultural resources. Collectively drawing on indigenous critical theory, oral history, disability studies and environmental humanist scholarship alongside history of science approaches, we attempt a different reading: of colonial translational modalities impoverished socially, spiritually and ecologically; and of colonial knowledges translated and transformed into potentially decolonizing instruments of indigenous cultural sovereignty.

Indigenous Nuclear Technologies, Development, and Sovereignty: The Atomic Age in Argentina and Brazil

Christopher Dunlap
Naval Postgraduate School - Visiting Faculty

From 1945 to the present, scientists, technicians, and diplomats in Argentina and Brazil have been among the developing world’s vanguard in harnessing the promise and power of nuclear energy technologies. The Atomic Age created a wholly new set of criteria of modernity to which a nation’s leaders and citizens might aspire. It also offered an unparalleled opportunity to refashion the relationship between science and the state, and that between the developing scientific periphery and the technologically advanced nations of the North Atlantic.

Brazil and Argentina have stood, since the 1980s, among a different club of elite nuclear nations, joined by only four countries that have uranium enrichment facilities that nonetheless chose not to build nuclear weapons. While much of the unbridled pursuit of advanced nuclear technology in these South American neighbor countries can be explained as an attempt to realize long-sought economic development, other aspects of this history of technology and diplomacy fit much more neatly into a defiant assertion of sovereignty against a North Atlantic center increasingly opposed to transfers of nuclear materials and technologies. How did Argentina and Brazil learn the rules of the new nuclear game, and how did they rewrite them to their own ends? What did responsible global citizenship and sovereignty mean within and outside Latin America as the Atomic Age progressed? This paper examines these two questions of nuclear technology and diplomacy against the larger background of economic and scientific development.

Industrial and State Secrecy in Twentieth-century Research and Development Work: Kodak as a Case Study

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A “silver curtain” of secrecy separated Eastman Kodak’s photographic emulsion researchers from their co-workers and professional colleagues in the Cold War United States. As the popularity of this metaphor among Kodak’s laboratory workers suggests, the firm’s concern about divulging insights into the chemistry of silver halide emulsions partly stemmed from its participation in military initiatives such as project Corona, the satellite reconnaissance program. However, Kodak’s extensive use of secrecy predated the start of the Cold War by more than half a century. As early as the 1890s, the firm had introduced policies of classification, compartmentalization, and fragmentation, while also restricting the mobility of its technically skilled personnel by means of employment contracts and non-compete agreements. While some of these measures were relaxed in the following decades, none was fully abandoned. Drawing on the Kodak Historical Collection and other newly accessible archival sources, this paper aims to contribute to a better understanding of the relationships between industrial and state secrecy in twentieth-century research and development work. I first demonstrate that, during World War I, Kodak’s emulsion researchers were allowed to collaborate relatively freely with the Army and the Bureau of Standards on the development of aerial photography. Afterward, however, Kodak was no longer willing to support emulsion studies outside of its own closely controlled facilities. Similarly, despite the program’s highly classified nature, project Corona did not involve access or communication restrictions to which Kodak’s emulsion researchers had not previously been accustomed.

Innovation on Standby: Political Pitfalls, Economic Uncertainty, and Scientific Frustrations in Local Computer Innovation at Rio de Janeiro’s National Computer Science Laboratory (LNCC)

Beatrice Choi
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While the recent Lava Jato financial crisis and impeachment of ex-president Dilma Rousseff have resulted in widespread repercussions across Brazil, this string of national events has been absorbed with a decolonial view that approaches these events as the latest wave in a series of violent oscillations understood as Brazilian history. This paper examines the ways in which Brazilian technological experts have constructed a culture of innovation despite, or because, of such contingencies and crises.

In a case study on computer innovation in Brazil, I analyze the National Computer Science Laboratory (LNCC) established in Petropolis in 1980. The LNCC has received recent media coverage for building South America’s largest supercomputer, “Santos Dumont”, and for its high profile international projects like “Pampa Azul”, which focuses on genetic mapping of the Zika genome. However, due to the LNCC’s most recent, highly publicized budget cutback in response to the crisis, the laboratory has placed a significant number of its projects on “stand by”, resulting in immediate questions of closure for the LNCC. Utilizing archival and ethnographic methods, this presentation examines the complicated business of scientific innovation in Brazil in crisis mode. The laboratory’s use of open-source software geared towards scientific discovery provides a unique example of national innovation while at the same time presenting a case for how the government continues to support its scientific platforms despite state-wide budget cuts.

Institutionalizing Scientific Internationalism? Diplomacy at Work in the Physical Sciences during the Cold War and Beyond

Roberto Lalli
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‘Scientific internationalism’ in the ideals and practices of the physical sciences has become a crucial object of analysis to better understand the history of Cold War science. While the number of international scientific collaborations experienced a dramatic growth from the end of World War II onward, the character and finalities of these collaborations changed substantially and overlapped diplomatic activities that were implicitly or explicitly reflecting the changing political
circumstances in which they developed. In particular, while before the Cold War scientists could promote international work without necessarily taking into account the geopolitical landscape, during the Cold War this became an inescapable referent. The panel offers a platform to investigate the multiple forms that ‘scientific internationalism’ assumed by focusing on the scientific activities of international organizations of different kinds. The speakers present case studies concerning the diplomatic implications of scientific collaborative efforts during the Cold War and beyond: from the changing role of international cooperation in astronomy to the search for ways to boost the scientific unions’ neutrality and collaboration across political divides to the scientific and political agendas of physical societies and multilateral defense alliances.

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**Is Compositionist Chemistry the Paradigm for Reductionist Science?**

Hasok Chang  
*University of Cambridge*

One of the rare instances in which chemistry has been present in the “big picture” discussions of the history of science is John Pickstone’s emphasis on the role of Lavoisierian chemistry in the establishment of analysis as a way of knowing. I have previously tried to build on Pickstone’s work to discern a longer history of the development of “compositionist” thinking in chemistry. In this paper I would like to suggest that 19th-century atomic chemistry has served as a model for micro-reductionist practices that became pervasive in modern science, including the biological and social sciences. While physics is often taken as the foundation for reductionist science, the development of physics through the 20th century has actually pushed against naïve ideas of material composition. Rather, it is pre-quantum chemistry that has continued to provide the image of compositionist science underlying much of the philosopical and popular discourse about science by scientists and others alike.

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**Is Economics an Exact Science? William Stanley Jevons on Economic Knowledge**

Adrian K Yee  
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William Stanley Jevons (1835–1882) is no stranger to historians of 19th-century economics. Jevons’s contributions to economics have been widely discussed including, but not limited to, a systematic overview of his economic writings (Peart, 1996), his use of mathematics (Schabas, 1990), to what extent he influenced neoclassical economists (Winch, 1972), and commentary on ‘Jevons’s Paradox’ (Alcott, 2005). His central contribution lies in the great influence he had on future economists in being among the first to employ mathematical reasoning, specifically the methods of differential and integral calculus, to economic concepts. As Margaret Schabas writes: “[H]e was the first to argue systematically that the true science of economics called for mathematics, and he persisted in promoting this cause throughout his career” (1989, pp. 61–62). While many have written on Jevons’s views in philosophy of science more generally, this paper focuses on elucidating Jevons’s remark in The Theory of Political Economy where he says “I do not hesitate to say...that Economics might be gradually erected into an exact science” (Jevons, 1871, p. 21). While Schabas (1984) argues Jevons did not actually think of economics as an exact science, concluding her paper with the comment that “an algebraic analysis of the quantitative relationships of the economy would actually serve to clarify the approximate nature of such knowledge” (p. 146–emphasis added), I seek to elucidate what Jevons might have meant by economics as an exact science.

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**Jesuit Beans and Vomitory Nuts: Mobilising Indigenous Materia Medica in the Late Seventeenth-century Philippines**

Sebestian Kroupa  
*University of Cambridge*
When stationed in Manila, the Jesuit pharmacist and missionary Georg Joseph Kamel (1661-1706) produced extensive accounts about Philippine flora, which were later printed in Europe. Drawing on the example of the St Ignatius bean, a medicinal plant native to the Philippines monopolised by the Jesuit order, I will explore Kamel’s strategies in mobilising local materia medica from the indigenous into a European context. I will argue that in introducing the ‘Jesuit bean’ to his European readers, Kamel downplayed its novelty and identified it with the nux vomica of the medieval Arabian physician Serapion, whose work had been adopted into European traditions centuries ago. This association endowed the plant with a clear place within European frameworks of knowledge, as well as with specific virtues: nux vomica means literally a ‘vomitory nut’. To bolster this carefully constructed link, Kamel provided accounts of medical cases which clearly attested to the emetic qualities of the plant. Perfectly blending erudite and empirical evidence, Kamel thus managed to smoothly transplant the St Ignatius bean into Europe. I will briefly contrast these Jesuit efforts to mobilise indigenous remedies and introduce them on the European market with those of the Spanish empire, which struggled to exploit local natural resources with such efficiency. I will suggest that—at least in the late seventeenth-century Philippines—Jesuit motivations, networks and modus operandi were more strongly aligned with extraction and exploitation of indigenous knowledge than the concerns and inner workings of the Spanish empire.

Joshua Marshman Reads the Kangxi Zidian Rhyme Tables

Research on the Chinese language, as opposed to practically-oriented language study, constituted an essential aspect of academic sinology as it developed in Europe in the nineteenth century. In 1814, Joshua Marshman published a book on the Chinese language with the intention to systematically describe the prestige pronunciation of the Chinese language of his time. The book appeared at a time of increased interest in the Chinese language, with Robert Morrison’s Chinese-English dictionary following soon after. Another aspect of Marshman’s book, however, was contrary to current trends. At this time of increased trade and contact with China, Morrison claimed to record current pronunciation; Marshman,
rather, chose to appropriate the gains of a Chinese scholarly discipline. His source was the phonological tables included in the imperial dictionary Kangxi zidian, published in Beijing in 1716, which had sought to circumvent the inconvenience of Chinese characters through a system that was difficult even for Chinese scholars to master. Marshman’s choice was met with incomprehension by Jean-Pierre Abel Rémusat, the rising star of French academic sinology: If the European researcher was already armed with the Roman alphabet, a fine tool for phonetic description, why would he choose to rely on the arcane tools that a non-alphabetical civilization had developed merely to mimic what was literally at the fingertips of every educated European? This paper will use the case of Marshman to consider the role of Chinese scholarly knowledge in European research on linguistics in the nineteenth century.

The scientific status of Berzelius was crucial to the influence of the journals he founded, edited, and contributed to. They, in their turn, were of vital importance in establishing—or re-establishing—the Academy of Sciences as a notable player in a diversifying institutional scientific landscape, where knowledge circulated according to emerging hierarchies and power relationships.

Studying the changes in exchange practices during the 19th century highlights the practical conditions for the circulation of scientific knowledge, and the fundamental importance of exchange networks in the moral, as well as monetary, economy of science.

Just Facts?: Evidentiary Frameworks of Forensic Conviction

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Centre for the History of Science, Technology and Medicine, University of Manchester

Contemporary forensic science has achieved unprecedented visibility as a uniquely compelling example of applied expertise. Dominated by new laboratory-based techniques, practitioners and the public they serve live in an apparent era of forensic infallibility, characterised by precision methodologies deemed capable not merely of solving the most intractable of contemporary criminal cases, but also of assessing, and correcting, conclusions derived from past investigations. This fascination rests on a normative standard of forensic truth, determined in particular by the practices and procedures of DNA typing, which has impoverished our ability to recognize, understand, and explain forms of forensic practice operating in other times and other places. The purpose of this panel is to explore ways of thinking about forensics, past and present, from a broader, historical and trans-national perspective. The papers raise questions about the importance of “location” (temporal and spatial) to the production and enactment of forms of forensic knowledge—differences in legal systems (e.g. burdens of proof, roles of experts and witnesses), in scientific institutional infrastructure and the degrees of
credibility that they sustain, in the skills and distribution of investigative personnel, in financial and practical constraints on investigation, and in the popular cultures of forensics and of criminality within and against which forensic practitioners operate.

Keeping Fit: Black Reproduction and Race Survival, 1890-1930

Wangui Muigai
Brandeis University

This paper explores African American ideas and concerns about reproductive health in the early twentieth century. African Americans—as parents, physicians, and intellectuals—debated the best ways to bear and raise healthy black children at a time when eugenic campaigns and public health initiatives drew increasing attention to the importance of family planning. At the same time, intensifying racial violence introduced new political stakes in the decision to bear children or terminate a pregnancy, and black women linked concerns about giving birth to threats of racial and sexual violence. Through public forums, including newspaper health columns and magazines, black women discussed whether their reproductive history and experiences during pregnancy could cause a miscarriage, premature birth, or somehow “mark” their child. Their concerns about maternal marking had roots in folklore and science, including Lamarckian theories of the inheritance of acquired characteristics. Drawing from sex advice manuals, black historical newspapers, and medical articles, this paper situates these concerns within broader debates about racial fitness, reproduction, and hygiene.

Kepler’s Rejection of Circularity, as shown on the Crucial Folium P356 of the Mars Notebook

William Donahue
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In early April of 1602, Kepler took what was to prove a fateful step in working out his Mars theory. He had already formulated a prototype of the “area law,” which we now know as his Second Law. This, he thought, would be a more accurate replacement for Ptolemy’s equant, which he saw as a stand-in for a dynamic principle. But, he wondered, would it really be more accurate than Ptolemy’s geometrical model? To answer this question, Kepler conducted a simple and methodical test, comparing positions and times generated using the area law on a circular orbit with the empirically correct positions and times. The test covers two sides of a single sheet of paper (folium P356 of the Mars Notebook), and by the end of the inquiry Kepler had concluded that the test failed for a circular orbit, but would succeed if the orbit were made very slightly oval. Rather than abandoning the area law, Kepler took the radical step of developing the physics and geometry of the orbit, now presumed to be some kind of oval. Using photographs of the manuscript page, Kepler’s reasoning will be summarized step-by-step. We will see, as if looking over his shoulder, how he arrived at the crucial discovery of the nine arc-minute discrepancy that led to the abandonment of circularity in planetary theory.

Knowing Nature: An Interspecies Enterprise

Katie Sullivan-Thomas
Mississippi State University

The proposed panel seeks to bring together recent trends in the history of animals, science, and the environment to expose how animals and their bodies participate in the knowledge production of human science. Our papers demonstrate that the knowability of nature around the world is directly related to human relationships with animals. Joseph Horan explores animal agency in Napoleon’s imperial exploits, finding that state power was fundamentally altered not only by animal actions, but also human ability to interpret those actions. Jules Skotnes-Brown interrogates the impact of economic ornithology in colonial South Africa, where it challenged veterinary understandings of disease and animal value from the 1900s to 1930s. Kathleen Thomas’s paper investigates the epidemiological emphasis on “wild diseases” in the mid-twentieth-century United States and how those control programs helped create a world in which
humans could co-exist with “the wild.” Finally, Abeer Saha exposes the inextricable links between industrial livestock farming, government, and land-grant colleges, all connected by the reorganization of livestock’s relationship to nature. This panel moves beyond reading animals as representations of human society to assert that animals have participated in the construction of societies. They and their bodies presented challenges to the human experience, crossing boundaries and borders and carrying disease as they moved. Human world-building confronted these obstacles in a number of ways, restructuring environments and altering bodies to bring the human and nonhuman into alignment.

La Bastille Alchimique: Suspicion and Optimism about Transmutation in Early Eighteenth-century France

Lawrence Principe
Johns Hopkins University

The importance and profile of transmutational alchemy in royal and princely courts of the early modern period, particularly in German lands, has been a valuable area of research for some time. Hopeful transmuters, or those with other valuable chymical knowledge, frequently offered themselves and found patronage at such courts, and often enough ending up imprisoned or executed. The French crown, on the other hand, avoided alchemical speculations, and through the seventeenth century, Louis XIV and his ministers positively forbade chrysopoetic endeavors in connection with state activities, such as by members of the crown-sponsored Académie Royale des Sciences. Nevertheless, this situation changed dramatically in the early eighteenth century when several high ministers of state engaged with reputed transmuters, and appear to have had them actively sought out. This paper will detail this remarkable change of heart, its causes and results, by following the histories and activities of several such transmuters and their relations with multiple arms of the French state. It will also offer a portrait of the strangely bifurcated reputation—oscillating between hope and fear—of chymistry and its practitioners in the period, with implications for explaining why chrysopoeia suddenly “went underground” in France in the 1720s.

Laboratory Life across Frames: Science and Scientists in the Early 1950s People’s Republic of China

Lu Liu
University of Wisconsin-Madison

In 1952, the People’s Republic of China (PRC) initiated a propaganda campaign against the U.S. army’s use of germ warfare during the Korean War. In what followed as "proof race" between the two divisive Cold War powers, the socialist regime produced a massive report out of scientists’ on-site fieldwork and laboratory examinations that attested to the truthfulness of the germ warfare claim. Featuring "scientific facts," the report exemplified collaborative efforts to (re)invent scientific narratives for the sake of integrating science into political legitimacy and socialist construction. This paper maps how narrative modes in the scientific document traveled cross media and genres into the 1954 propaganda play Bright Skies that reflected upon Chinese scientists’ participation in the germ warfare investigation. Not only did the playwright Cao Yu refer back to details from the report, Bright Skies also imaginatively delved into untold stories behind the production of objective scientific activities. Through dramatization, the backstories lay bare the entanglements of scientific practices, politics, and personal choices, and thus unintendedly resonate with Bruno Latour’s observations on the laboratory life and construction of facts. The text and context of Bright Skies, I argue, provide a glimpse into the reconfiguration of science and scientists in the specific situation of the early 1950s PRC. An intertextual and contrapuntal reading of the report and the play also reveals where science and literature overlap in knowledge production through storytelling.

Late Medieval or Baroque: Epochal Thresholds, Styles of Thought, and Mathematical Practices in the Seventeenth Century
The question of the periodization of early science is connoted with political concerns: whether Pierre Duhem’s "discovery" of Medieval Science in the context of radical Catholicism in early twentieth century France; Herbert Butterfield’s cold war notion of the scientific Revolution as surpassing any social upheaval in its historical significance; or Hans Blumenberg’s generalized notion of the history of science as the modern quest for legitimacy. The "earliness" is either the fruition of an even earlier scientific tradition, or as an Athena emerging from Jupiter’s head, signifying the dawn of a new epoch. Instead of reviewing these notions of early science through the monolithic threshold, this paper will posit the multiplicity of styles of thought embedded in specific mathematical practices as enabling a different historical assessment of early science on its own terms, neither as an enfeebled ripening nor as an anachronistic precursor. To probe the possibilities of this approach I will apply Walter Benjamin’s notion of Baroque with (following Elkana) Bertolt Brecht’s notion of the epic to the history of optics from Kepler’s ’Ad Vitellionem paralipomena’ of 1604 to Descartes’ 'La dioptrique’ of 1637.

In the study of the conflict thesis of science and religion, two central questions persist: Why does belief in inevitable historical conflict between science and religion remain current, in spite of over a half century of historians’ best efforts to refute it. Why did this belief and its central narrative, which existed well in advance of the year 1800, go viral, rising suddenly to international best-seller status in the last quarter of the nineteenth century? This paper suggests the answer to both these questions is closely linked. It examines the work of Victorian-era scientific naturalists, theologians, and scientists of religious faith. The first group is represented by well-known members of the X-Club in England, such as John Tyndall, T. H. Huxley, the philosopher Herbert Spencer, and their counterparts in the United States such as Simon Newcomb, John Draper, and Andrew Dickson White. Theologians include James B. Mozley, who debated Tyndall on the efficacy of prayer, Henry Drummond, and their conservative American counterparts at Princeton Seminary. The third group includes theologically engaged men of science such as William Whewell, John Herschel, Charles Lyell, James Clerk Maxwell, and American counterparts such as Asa Gray, George Frederick Wright, and William North Rice. Careful examination of the nuances of the concepts of laws of nature, divine action, and natural science as a means of knowing, particular to the late Victorian era and reappearing thereafter, offers significant promise for answering questions of the sudden widespread dissemination of the conflict thesis and its lasting influence today.
Hellerau can be understood as part of the Lebensreform movement in Wilhelmine Germany, a phase that allowed for unconventional practices in seeking answers to the social question. At this time, the antagonism between techno-scientific rationalism and neo-Romantic utopianism appears to be less stark than portrayed so far. What it meant to conduct an experiment was not solely defined in the scientific laboratory in Hellerau. On the contrary, experiments were carried out in the private and in the public, in the factory and on stage. Therefore, experimental language and practice cross-fertilized and developed between artistic, techno-scientific and socio-political realms to the end of advancing modern social life.

Lively Artifacts: Heinz von Foerster and the Machines of his Biological Computer Laboratory

Jan Müggenburg
Leuphana Universität Lüneburg

Over the course of the twentieth century, the concept of life has been loosened from its moorings to nature. Launched in 1958, the Biological Computer Laboratory (BCL) at the University of Illinois Urbana-Champaign provided the institutional and political context to stage the ‘liveliness’ of machines, an unprecedented and understudied development in the history of twentieth-century science. In this talk, I show how the BCL explored to serve examples from nature as templates and standards for engineering machines and computer programs. The lab’s artifice ranged from self-organizing automata to artificial sensory organs in neural networks, remarkable prefigurations of contemporary robots and computer programs from the realm of artificial intelligence. Drawing on the archives of the BCL, the personal collection of its founder, Austrian physicist and cyberneticist Heinz von Foerster, and oral histories, I reconstruct the lab’s working world using insights from historical epistemology and media archeology. In doing so, I examine both the historical conditions under which these machines appeared ‘lively’ and how they yielded knowledge as scientific media. The spectator-dependency of such machines, I argue, allows us to situate ‘liveliness’ as a driving force in the transition from a first-order cybernetics of communication and control to a second-order epistemology of embedded observation.

Livestock, Patients, and Profits: Veterinary Medicine and the Changing Landscape of Rural Economy

Kit Heintzman
Harvard University, History of Science

When France opened the world’s first veterinary schools in the 1760s the Crown changed its relationship to non-human animals and reconfigured a new set of social and scientific categories for livestock. The principle innovation of veterinary medicine was not the act of healing animals—a project arguably as old as domestication—but rather the production and regulation of medical professionals who could act as intermediaries between individual estates and the state. European rural economy guides published throughout the long eighteenth century focused on the farmscape’s diverse inhabitants—horses, cattle, sheep, pigs, dogs, cats, chickens, geese, and falcons. These animals were situated in a vast landscape of external threat, including miasmas, wolves, and snakes. The attention to national interests that directed veterinary practice, however, newly divided the kingdom’s animal population into those that merited systematized and regulated medical attention and those that did not. Veterinarians segmented their focus upon those animals associated with the national economy—horses, cattle, and sheep. While veterinarians reordered the value of life within the estate, they also grew increasingly concerned with multispecies corporeal interactions, especially those of bodily mites and “parasites”. I argue that the re-grouping of “healable-animals” was accompanied by new views about threat that focused on the bodily integrity of the individual animal patient. A part of moving veterinarians into the individual estates was reflected in further individualization of individual animal bodies themselves, even as their “healability” hinged on their placement in a particular economic category.
Looking through a Marginal Perspective: Sensory Integration, Autism, and the Evolvement of Occupational Therapy

Wen-Ching Sung
University of Toronto, Institute for the History & Philosophy of Science & Technology

Over 90% of children on the autism spectrum have sensory challenges. But sensory difficulty is not recognized as one of criteria for an autism diagnosis until DSM V released in 2013. This late recognition of sensory processing raises several critical questions: What symptoms are required for a diagnosis? What is the core of autism? For some, sensory integration is a crucial lens to understand children’s social difficulty and delays in language development. Some even argue that sensory integration disorder should be a distinct category in DSM. Therapies targeting on sensory problems have existed since the 1950s. Occupational therapist Jean Ayres proposed sensory integration therapy (SIT) to treat children with learning disorders and autism in the 1950s. Around the same time, psychologist Newell Kephart utilized perceptual-motor therapy to help children with minimum brain injury. But sensory processing has remained a marginal perspective in defining and treating autism. Why? We will trace the evolvement of sensory integration as concepts and practices from the 1950s till now. We will use this history as a way to examine the development of occupational therapy and the understanding of autism.

Lost in Translation: Symbolic Formalisms and Mathematical Embodiment in the History of Mathematics

Clare Kim
HASTS, Massachusetts Institute of Technology

Historians of mathematics have increasingly appreciated the role of written practice and bodily perception in producing mathematical research. In treating the relationship between thought and symbolic formalisms, for instance, they now avoid reproducing notions of universal and disembodied cognition. Yet little attention has been paid to how notions of disembodied cognition came to be in the first place. This talk examines how historians of mathematics negotiated conceptualizations of race in their studies of symbolic formalisms and their imagined relation to cognition. In particular, I focus on the efforts by David Eugene Smith and Yoshio Mikami to produce a history of Chinese and Japanese mathematics for an American readership in the early twentieth century. Analyzing their efforts to translate and categorize mathematics of the “Orient,” I show how Smith and Mikami’s assertions of equating “Oriental” mathematics with the formalized axiomatic approach of the early 1900s depended upon treating mathematicians monolithically, without regard to changes and differences of racial ideology.

Making Room for the Natural Sciences in Seventeenth Century Morocco

Justin Stearns
New York University Abu Dhabi

In Morocco during the seventeenth century a significant minority of Muslim scholars studied and wrote works on the natural sciences. How do we go about telling their stories? This paper lays out the historiographical challenges of narrating the history of the natural sciences in the Muslim world during a period widely considered to have been one of intellectual decline, and then turns to a preliminary evaluation of the medical, astronomical, and alchemical works written in Morocco during this period. The historiographical challenges are many and are related to much of the research on the natural sciences in the Muslim world having been preoccupied with two topics, 1) the translation and appropriation of Greek and Indian sciences by Muslims and those living under their rule in the eighth-tenth centuries, and 2) the influence of Muslim writings on European Christian scholarship between the twelfth and sixteenth centuries. What Muslim scholars wrote following the beginning of what is still often glossed as the Scientific Revolution(s) of the sixteenth-eighteenth centuries has been neglected. Within the field of Islamic
studies, recent work on the intellectual history of the early modern period allows us to contextualize scholarship on the natural sciences during this period. Using the writings on timekeeping of al-Rudani (d. 1094/1683), on material medica of al-Dara‘i (d. 1148/1734), and on alchemy of al-Marghiti (1089/1678), this paper will conclude by situating their work within the educational landscape of Morocco, one that was shaped largely by rural Sufi lodges.

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Making Science Historical: How Narrative Structured Darwin’s Science

Greg Priest
Stanford University

As has been frequently remarked, Charles Darwin often used narratives to explain evolutionary change, as when he traced how the eye might have evolved from a patch of light-sensitive skin into a complex optical instrument. But narrative played a more fundamental role for Darwin, and one far less well-understood: narrative fundamentally informed the concepts out of which Darwin constructed his science. It is straightforward enough that Darwin’s two most important conceptual innovations—natural and sexual selection—are narrative in structure. But Darwin also repeatedly took concepts that other natural historians had conceived as expressing static properties and reconceptualized them through a narrative lens. Taxonomists, for example, typically conceived affinity as a static relation of morphological similarity; Darwin reconceived affinity as a historicized relation of genealogical connection. He also took what other naturalists conceived as invariant laws of nature and reconceived them in narrative terms, as when he argued that Baer’s “laws” of unity of structure and unity of plan in embryology should be understood as consequences of processes of historical change. Darwin even offered narrativized reconceptualizations of sex, beauty, and morality. Finally, narrative structured the standards by which Darwin conceived that scientific hypotheses should be evaluated. In the place of John Herschel’s notion that a phenomenon is explained by breaking it into its component parts and offering a vera causa (true cause) for each part, Darwin proposed that explanations be evaluated holistically for how they made sense of a wide array of disparate phenomena. Narrative, in short, suffused Darwin’s science.

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Man and Nature

James Bergman
Temple University

In 1955, the climatologist C. Warren Thornthwaite presented a paper to the conference on Man’s Role in Changing the Face of the Earth in which he proposed a way to improve the “water economy” of drought-prone regions. The language he used was one of “balance,” and the hope that he had was not that he would make the area better, but that he would correct “defects” in the climate. The rhetoric of “balance” pervaded the proceedings of the conference, from the introduction, which traced its ancestry back to the George Perkins Marsh’s 1864 work, Man and Nature, in which Marsh called for the possibility of restoring the “disturbed harmonies” of the natural world. In this talk, I will trace the usage of the words “balance” and “harmony” in a selection of papers delivered to the conference, including those by ecologist Paul Sears, geographer R.J. Russell, and climatologist C.W. Thornthwaite, as well as through the transcribed discussions from the conference. I will examine it in relation to their intellectual inspiration, Marsh, as well as changing ideas about the relationship between the economy and the environment in the 1950s.

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Mapping the Future: Different Temporalities in Economic Forecasting

Laetitia Lenel
Humboldt-University Berlin

Despite numerous failures, economic forecasting has maintained its interest and importance. But both the forecasting instruments and the understandings of time that inform them have changed fundamentally. The paper examines three forecasting tools, developed by American and European economists and
businessmen from 1920 until 1955, and investigates the different temporalities associated with the tools and their implications. In the early 1920s, American and European economists celebrated the (1) Harvard Index of General Business Conditions, which was based on a cyclical understanding of time, as the first “scientific” approach to business forecasting. But the unstable economy of the 1920s and 1930s and the growing influence of the Federal Reserve prompted contemporaries to question the index’s value. Because the past was no longer perceived as a reliable guide to the future, economists and businessmen on both sides of the Atlantic experimented with forecasting approaches that were based on a linear understanding of time. The paper goes on to discuss the (2) Leading Indicators established at the National Bureau of Economic Research in the 1930s and the (3) survey-based forecasting approach employed by American companies in the aftermath of the Great Depression and, two decades later, by economists in Europe. While the Leading Indicators were based on data from the past, but allowed for a dynamic, time-variant application, the surveys inquired about the expectations of economic agents. By investigating the different designs and workings of the tools, I show that their different temporalities brought about different interactions between economic and political decision-makers.

Marine Biology, nationalism, and nature’s body: marine biological surveys in Republican China

Christine Luk
University of Hong Kong

In Republican China, controversies over antiquities and fossils management during Western expeditions in China prompted new laws and policy regulating foreign biological expeditions in China’s interiors. Luo Guihuan has examined the restrictions introduced by Academia Sinica to limit Westerners’ collecting endeavors of Chinese fauna and flora while Fan Fa-Ti has analyzed the ways in which natural history was incorporated into the nation’s body in Republican China. However, most of these “restrictions” triggered by nationalistic sentiments were targeted on terrestrial exploration, mostly in Northwestern China (such as the Central Asiatic Expeditions of the American Museum of Natural History), where the spotlight was placed on fossils or endangered species such as pandas. Historians of science have suggested that animals and plants are not just objects of naturalists’ interests but also subjects of nationalists’ sentiments in the age of Western imperialism. But most of the available evidence came from terrestrial flora and fauna, without much discussion of the connection between nationalism and marine flora and fauna. Drawing from the evidence of the marine biological surveys in Republican China, this paper explores the relationship between marine biological expeditions and nationalism, and suggests that while coastal biological organisms were imbued with local meanings, marine biological research in Republican China was essentially a transnational enterprise and not restricted the same way as land-based investigations.


Theodora Vardouli
McGill University

In June 1966 Hungarian-French architect Yona Friedman traveled to Folkestone, UK to join the International Dialogue of Experimental Architecture (IDEA) – a large two-day symposium on radical experiments with architecture and urbanism. A leading figure of “prospective” international groups of architects and artists crafting techno-futurological visions of three-dimensionally expanding cities, Friedman was a natural participant in what aspired to be a convocation of “all Europe’s creative nuts.” Yet at IDEA, Friedman set aside the provocative imagery of the Ville Spatiale – the architectural rendition of his late 1950s theory for “mobile architecture,” and instead presented the project through mathematical diagrams. These diagrams were part of a theory of “scientific architecture,” as he would later call it, that Friedman was developing through visiting
appointments in US and Canadian research universities. While being enthusiastically received in North America, Friedman’s mathematical exposition was met with skepticism at IDEA and reviewed as a “pseudo-mathematical” and “naive” way of justifying his aesthetic preference for space-grids. This presentation follows the mathematization of Friedman’s architectural work in its transitions and translations between North American research universities and the 1960s French architectural scene. By examining how distinct epistemic cultures influenced and received Friedman’s claims to “science,” I shed light on collusions and collisions between postwar academizing tendencies in research universities and contemporaneous avant-gardist cultures of novelty and prospectiveness in architecture. I also dwell on how particular mathematical ideas allowed Friedman to negotiate a space between the “researcher” and the “artist-demiurge,” between aniconic rationality and the aesthetic consistency of his oeuvre.

Matter and Body: Complementary Explanations of Physical Causation in the Middle Ages

David Cory
University of Notre Dame

Matter and body are conceptually distinct ways of addressing the same physical reality, i.e. that which is fundamental in physical reality. Hence, material causes and bodily causes are on the same explanatory level, or so it seems to us. Yet medieval explanations of physical causation took a different route entirely, and adhered to a dual explanatory model in which matter and body play complementary roles. The 13th-century Dominicans, Albert the Great and Thomas Aquinas, for instance, distinguished matter from body, and supplied them with different functional roles in physical causation. For them bodies are the things in ordinary experience which cause via contrary causal features (e.g. heat and cold). In contrast, "matter" is a more complex concept, usually referring to something like a susceptibility or openness to the causal features of body. Matter and body are both required in medieval paradigms of physical causation. In my paper, I will shed light on the basic meanings of the two complementary concepts in some select 13th-century thinkers, and on the role of matter in particular in explaining causal action among bodies.

Matter of State: Alchemical Controversies in Early Modern Courts

Jennifer Rampling
Princeton University

This session investigates how early modern European courts influenced, and were influenced by, controversies over natural knowledge, taking alchemy as its exemplar. Alchemy was always a politically-inflected science, whose practitioners promised to both preserve and enrich the person of the prince by supplying cheap bullion and powerful medicines. Despite this potential, the intricacy and obscurity of its methods, and the bad reputation of many of its practitioners, meant that investing in alchemy was often a gamble for princes and their ministers. How, then, did patrons and practitioners negotiate the tension between optimism and suspicion, in order to produce useful knowledge and valuable goods? Our three papers seek to answer this question by unpacking the political and economic implications of alchemy and related arts across diverse courtly settings: late medieval and Tudor England, sixteenth-century Germany, and eighteenth-century France. Each context generated its own concerns. English monarchs worried about alchemy’s associations with magic, German princes were alarmed by allegations of poisoning, and French academicians sought to associate transmutation with fraud. In the face of such concerns, practitioners also took risks, as they struggled to market their techniques, win financial security, and avoid the worst pitfalls of courtly life—including the machinations of rivals competing for favor and resources.

Measure of the Mind: Phrenological Character Charts and the Marketing of Self-Knowledge
In 1843 a phrenologist examined the skull of Benjamin Franklin Perry. He presented his subject with a chart rating the strengths and weaknesses of his mental developments: Amativeness large, Combativeness large, Acquisitiveness full. “He gave my character entirely and perfectly,” Perry marveled. The chart revealed Perry to himself. “It seemed like unlocking to me my bosom.” Phrenologists sold self-knowledge in the form of character readings. After an examination of one’s cranial morphology, one could purchase a chart documenting the phrenologist’s numerical evaluation of each organ of the brain. Some phrenologists offered manuscript versions of these charts: detailed descriptions of a customer’s character, with practical suggestions for self-improvement in the realms of education, marriage, diet, and other aspects of life. Though handwritten, these charts were often not as personalized as they seemed. Phrenologists could treat their customers as members of generic groups, commodifying individual self-knowledge through technologies of mass production. This paper examines the business of phrenological readings, with an emphasis on the American practical phrenology in the antebellum years. How was self-knowledge bought and sold in the era of the idealized “self-made man”? How did customers understand and make use of their character readings?

Measuring and Conserving Hearing/Hearing Loss in Postwar America

Jaipreet Virdi
University of Delaware

In 1943, the American Medical Association and the American Academy of Ophthalmology and Otolaryngology formed a joint “Committee on the Conservation of Hearing” composed of some of the top otolaryngologists and acoustic physicists in the country. Working in conjunction with the American Federation of Organizations for the Hard of Hearing, an advocacy group incorporating different social organizations—educators, social workers, and speech teachers—serving the needs of the deafened, the Committee devoted its primary resources to tackling the problem of childhood hearing loss. Yet, the Committee’s agenda of implementing national and state efforts to secure periodic hearing testing was, in fact, largely instigated by deafened people who perceived the need for standard guidelines for measuring hearing loss as vital to their ability to receive medical and employment benefits. After the war, however, the Committee’s primary agenda shifted towards the problem of occupational deafness and industrial noise. This shift, from a disability-focused perspective to an occupational one raises crucial questions about how researchers approached the problem of measuring hearing conservation and protecting hearing from the effects of noise exposure. Additionally, this presentation addresses the implications such a shift could have for how deaf and hard-of-hearing people were classified under new standards of measurement.

Measuring Bodies & Minds: Perspectives on Variation and Disability in the Human Sciences

Jaipreet Virdi
University of Delaware

Objectivity has often been used to refer to an ideal of scientific representation, facilitated by precise measurements and standardized instrumentation. During the nineteenth and twentieth centuries, clinical and research programs attempted to measure difference in human bodies and minds. Quantitative technologies and techniques that were, arguably, more “scientific” than qualitative descriptions, enabled researchers to determine more flexible “normal” ranges to juxtapose the abnormal and define parameters for creating categories of difference in disability, ability, and even race. How did quantification of difference, racially-defined deficiency, and anthropometric studies frame new epistemic authority for measuring human health? How did qualitative and quantitative indicators rely on technology and the pathological embodiment of medical surveillance? And to what extent did
researchers rely on statistics and measurement to create a relationship between what they considered to be “normal” and “abnormal”? As the papers in this panel show, however, changing values about the classification of human bodies and minds relied not only on expert studies, but also on the perspectives and self-knowledge of subjects. The quantification of human hair, the commodification of phrenological self-knowledge, the pathologizing of audiometric data, the development of formal guidelines for hearing acuity, and the need to stabilize diagnostic boundaries of mental deficiency were all dependent on normative responses to the study of human difference.

Measuring Deaf People: Approaches from Audiology, Genetics and the Psycho-Sciences, 1930-1970

Marion Schmidt
Georg August Universität Göttingen

Ever since the late 19th century, professionals from different disciplines have measured deaf people. Teachers and psychologists ascertained their intellectual achievements and psyche; eugenicists, anthropologists or physicians charted their family and medical history. The way this data was used reveals interdisciplinary coalitions and larger ideas about normalizing the disabled. Intelligence tests, for example were to be used for more efficient educational placement, but they also fed into a larger eugenic discourse that restricted access to schools of the deaf to the “normally” abled. Likewise, when schools started using audiometers in the 1930s and 40s, audiograms where initially meant for educational assessment, yet they also were useful in genetic research for tracing different types deafness in a family tree. The ways such data was collected and used often were pathologizing and gave little attention to deaf people’s perspectives. However, from the 1940s on psychologists and sociologists also became interested in the deaf as a social minority with a culture and language of their own. Interacting with local deaf communities, they grappled with ways of measuring normalcy and difference, and drew from contemporary theories of majority-minority relations, bias and discrimination, or sensory and cultural deprivation. Looking more closely at this research points to early origins of a sociocultural model of deafness and disability, which disability historians usually place with the activism of the 1970s and ‘80s; and provides insights to the different ways scientists and researched populations have interacted and established bodies of knowledge.

Measuring the Measures of the Ancients: Metrology, Philology, and Experimentation in Georg Agricola and Johannes Kepler

Cesare Pastorino
Technische Universität Berlin

This paper considers a group of early modern scholars who combined philological and experimental practices in their investigation of ancient systems of measurement units. Inspired by the groundbreaking work of Guillaume Budé (“De asse,” 1514), several humanists in the tradition of the treatises “de mensuris et ponderibus” developed an interest for the historical, rational examination of ancient measures. Some of them routinely weighed substances and materials as an aid to the philological study of ancient weights and measures. For example, Juan Bautista Villalpando (1552-1608) and Juan de Mariana (1536-1624) experimented on the weight of substances in a fully antiquarian fashion. This paper will focus on the little-studied research on historical metrology of two well-known authors, Georg Agricola (1494-1555) and Johannes Kepler (1571-1630). Agricola recommended that the philological study of texts on measures from ancient authors (Galen in particular) should be accompanied by trials and experiments on the weight of substances. Also, one of Kepler’s least studied works, the "Messekunst Archimedis" (1616), contains an extensive appendix, a self-standing antiquarian treatment of metrology and the study of ancient weights. Kepler’s examination of the subject combined philological analysis of ancient sources, the study of the tradition “de mensuris et ponderibus” and experimental investigation on the weight of substances. Overall, this early research on historical metrology shows a surprising mix of philological and
experimental methodologies, an example of a so far under-examined “antiquarian experimentation” at the intersection of the history of the humanities and the sciences.

**Medicine in Revolution: Mapping Homeopathy in the Landscape of Mexican Medical Science, 1861-1934**

Jethro Hernandez Berrones  
*Southwestern University*

As no other country in the Western Hemisphere, homeopathy consolidated as a medical science during the first two decades of the 20th century in Mexico. But what type of science homeopathy was? Three schools emerged as the providers of medical training in the city after the revolution (1910-1917), the National School of Medicine, the National School of Homeopathic Medicine, and the Free School of Homeopathy. These schools’ academic staff engaged in philosophical discussions explaining the relationship between medical science and homeopathy in the curriculum. The works of Fernando Ocaranza, David Cruz, and Higinio Pérez offer a set of views on the body, disease, and medicine that went from total rejection of alternative views such as homeopathy to total integration of science with homeopathy. Ocaranza used the new philosophical medicine of Claude Bernard to discredit the metaphysical explanations of bodily functions proposed by homeopathy. In the same line but emphasizing the importance of homeopathy, David Cruz proposed to use the mechanism of vaccination to explain the basis of homeopathy. Based on evolutionary, biological, physical and physiological arguments, Pérez discredited modern approaches to medicine that removed the human being as the center of all medical inquiries. He placed homeopathy as a medical science that explained how physical forces kept the natural world and the human body in balance. This paper examines their philosophical papers and places them in the context of reforms during and after the revolution that sought to continue the professionalizing and secularizing efforts of the Porfiriato (1884-1910).

**Memories of Rain: Climate Maps and German Colonial Revisionism**

Philipp Lehmann  
*UC Riverside*

The end of the First World War also marked the end of the German overseas empire. And while it was ultimately a rather quiet and subdued end, colonialism did not vanish without a trace. During the thirty years of German colonial presence in Africa, China, and the Pacific islands, geographers and climatologists had been busy collecting atmospheric data and mapping the climatic conditions of territories from the deserts of Southwest Africa to the tropical forests of the Bismarck Archipelago. In the 1920s these maps would not only serve as a reminder of the colonial past and material for further studies, but also as propaganda for colonial revisionism—practiced with particular vigor by the group of German geographers and climatologists who had worked in the German protectorates before the war.

This paper will trace the history of not only the scientific and economic circumstances of the creation of climate maps in the German colonies, but also their changing scientific and political valences from the colonial period to the post-colonial years of the Weimar Republic. While depicting the notionally borderless atmosphere, climate maps nevertheless contributed to the spatialization of the German Empire and, ultimately, to the Germanization of colonial space, which enjoyed its heyday only after the official end of German overseas colonialism. Finally, the paper will pose and begin to answer the question in how far the static display of climatic conditions on maps related to the desired—if ultimately fleeting—permanence of political borders in the colonies.

**Military Natures of Astrobiology: Life-on-Mars Studies in the Early Cold War**

Jordan Bimm  
*Princeton University*

Astrobiology, the scientific field investigating potential extraterrestrial life, is often understood as a
post-Sputnik development initiated by academic molecular biologists anxious to distance themselves from NASA’s quasi-military human spaceflight program. This paper complicates this origin story by examining the first-ever set of astrobiology experiments, which were carried out by the United States Air Force (USAF) in the mid-1950s. At the School of Aviation Medicine (SAM) in Texas, physiologists and microbiologists led by ex-Luftwaffe researcher Hubertus Strughold constructed small environmental simulations of Mars, and sealed hearty terrestrial microbes inside the freezing, desiccated, low-pressure, nitrogen-rich containers to see if any could survive. First called a ‘Marsarium’, after the terrariums used in colonial plant transportation, the name that stuck was ‘Mars Jar’. More than an academic exercise, the Air Force scientists used Mars Jar studies to understand what sort of life future astronauts might encounter on expeditions to the Red Planet, and how it could be used instrumentally to establish a military base there. Building on recent scholarship about the work of virtual representations of Mars by Janet Vertesi and Lisa Messeri, the story of these early physical simulations shows how astrobiology emerged as a Cold War military concern, and built-up Mars as a potential battlefield among other strategically-valuable extreme environments America needed to defend like the polar regions and the deep seas. Most crucially, it reveals ways that present-day astrobiology, focused on Mars and the icy moons of Jupiter and Saturn, retains an unchecked colonial gaze and instrumental regard for extraterrestrial life.

Mind out of Matter: Psychologie Physiologique and the Annus Mirabilis of Telepathy (1886)

Courtenay Raia
Colburn School

In 1885, the eminent neurologist Jean Martin Charcot convened the experimental Société de Psychologie Physiologique to keep the circle of hypnotic research expanding around his clinic at Salpêtrière. Early papers showcased edgy-enough experiments involving hallucinations, hashish, handwriting analysis, delayed trance effects . . . but at the November assembly, research trends broke out in a gallop in altogether new directions. Charcot had granted a broad research latitude in pursuing “how matter becomes mind,” but nothing in his directive would have encouraged the notion that mind might venture beyond matter. Yet, in four plainly coordinated papers, evidence for “telepathic hypnotism” was set boldly before the gathered membership, all but forcing the Société to take up the gauntlet. At the center of this overture was doctoral candidate, Pierre Janet, and his carefully observed investigation of “sommeil a distance,” but behind it all was Charles Richet, Charcot’s trusty subordinate who had, all the while, an agenda of his own. While this paper’s reconstruction of the Société’s timeline and social networks clearly points to Richet as the impetus for this run on telepathy, the energy he stirred was already there, suggesting a less monolithic materialism than is often assumed regarding his psychiatric cohort. Positivism, even for the French, might be as much a matter of professional conformity as personal ideological commitment. Rather than read the demise of telepathy at Salpêtrière as due to a lack of interest (namely Charcot’s), it would be equally true to consider that such interest was in dangerous excess.

Misconduct in the Scientific Revolution? The Case of William Gilbert

Scott Montgomery
University of Washington

William Gilbert (1544-1603), a founder of early modern science in Britain, was the author of De magnete (On the Magnet, 1600), esteemed by many later natural philosophers for its rejection of scholasticism and extensive use of experiment. Since the 19th century, Gilbert has been routinely celebrated as having discovered the fundamental laws of magnetism. In De magnete, he reviews preexisting works, giving slight notice to one Peter Peregrinus (13th c.). In fact, Peregrinus wrote a remarkable tract,
Epistola de Magnete (ca. 1268), detailing experiments on magnetic behavior and proposing the earliest dry compass. Over 30 copies are known, including a printed version, testifying to long-term use. Close comparison with De magnete shows beyond doubt that Gilbert plagiarized substantial parts of Peregrinus’ work. Though Gilbert’s Latin is not identical, the methods and materials, order of experiments, and derived “laws” all copy Peregrinus. Why Gilbert believed this would go unnoticed is unclear. Such an episode, however, is important for other reasons. It provides new support for direct connections between medieval and early modern science, an area of some debate. It also poses questions about what constituted “misconduct” at the time and whether similar examples of “borrowing” might have played a larger role in 17th century science.

### Mites, Mice, Molds, and Megafauna: Scaling Life Forms Under Science

**Kit Heintzman**

*Harvard University, History of Science*

Telling scientific stories is a multispecies affair. Non-human animals have been instrumental to studies of the world’s natural order, as model organisms for the human body, as experimental objects, as livestock to be cared for, and as theoretical proxies for human social organizations. Furthermore, the role of animals in labor, sustenance, and commerce has driven the concerted research of biologists, veterinarians, naturalists, and ethologists. These papers collectively examine the particular ways in which scientific practitioners have taken an interest in non-human organisms from the Early Modern period to today. From amoebae to megafauna, this session addresses the scientific production of knowledge regarding non-human life forms, and in turn queries the ways such knowledge feeds the construction of new forms of life. By spanning a broad range of morphologies—amoebae, insects, small mammals, and large mammals—these papers pay attention to how scientific knowledge is shaped by the bodies of creatures themselves and constructs relationships between species. By uniting early modernists with modernists, this panel explores the deep history of multi-species relations, while highlighting how changes in scholarly practices, evaluation of the role of missionaries as mediators of indigenous knowledge of nature. The various contributions offer an important exploration of ways in which the social, political, and religious contexts shaped the ways in which missionaries engaged with indigenous communities, imperial projects, and new natural phenomena. Drawing on archival and printed sources, this panel seeks to offer new insight into the ways in which the experience and activities of missionaries confirms and challenges existing narratives of empire, globalization, and cross-cultural interaction in the history of early modern science and medicine.

### Missionaries, Indigenous Knowledge, and Globalization in Early Modern Iberian Worlds

**Matthew Crawford**

*Kent State University*

With the commercial and colonial expansion of the Spanish and Portuguese empires in the early modern world, European missionaries played an important role in the interactions with indigenous peoples around the globe. In the course of the interactions, European missionaries intentionally (and unintentionally) collected, reported, edited, and filtered knowledge of the natural world from various indigenous and colonial communities. In many places, missionaries were the leading edge of European colonization and provided some of the first accounts of new natural spaces and specimens. Consider the example of José de Acosta, a Spanish Jesuit that served as a missionary in sixteenth-century Peru. His Natural and Moral History of Indies is considered to be on the earliest European accounts of American nature even though this work was part of Acosta’s primary goal to promote evangelization of the Americas. The papers in this session will present new research on missionaries in the Spanish and Portuguese empires and will engage in critical re-evaluation of the role of missionaries as mediators of indigenous knowledge of nature. The various contributions offer an important exploration of ways in which the social, political, and religious contexts shaped the ways in which missionaries engaged with indigenous communities, imperial projects, and new natural phenomena. Drawing on archival and printed sources, this panel seeks to offer new insight into the ways in which the experience and activities of missionaries confirms and challenges existing narratives of empire, globalization, and cross-cultural interaction in the history of early modern science and medicine.
economies, ontologies, and political concerns intersect across species divides.

**Modeling in Clay: Ecology as the Adhesive Between the Cracks of Geological Inference**

Ali Mirza  
*Indiana University, Bloomington*

This session explores the intersection of geology and ecology in the 19th and 20th centuries. The questions we pursue are: How did scientists use information from one time-period or region to infer features of another, distant, time period or region? How did they determine which questions were worth pursuing or prioritizing? Our answers are unified by an emphasis on how ecological considerations delimited what could be learned about a particular time period or region using comparisons with another time or place. Historians have discussed the fit between organisms and their environment, and have focused on the geographical distribution of species. Yet, the manner in which ecological considerations so consistently modified the practices and motivations of scientists has been under-discussed. By collecting three cases in which this occurred, we hope to motivate further research into how ecological frameworks determined the validity of certain inferences. Examples discussed include (a) testing the relatedness of animal forms to their environments to aid with reconstructions of past habitats from fossil data, (b) how Charles Darwin saw the complexity of ecological relations in coral reefs as delimiting predictions regarding their formation in unexplored areas, and (c) how disanalogies between the deep past and the present required paleoecologists to modify how knowledge of the past could be useful for predicting the future. In all cases, scientists were concerned not merely with using known information to predict unknown features (past, present, or future), but with the construction of frameworks which discerned when such inferences were reasonable.

**Modelling the Nuclear Winter: The Role of ICSU between Environmental Research and Nuclear Diplomacy**

Giulia Rispoli  
*Max Planck Institute for the History of Science*

Since the second half of the 20th century, the International Council of Scientific Unions (ICSU) has sponsored international initiatives to investigate the Earth as a physical, chemical and biological system put in danger by human activities. In this context, a prominent collaboration emerged in the 1980s involving geophysicists from the US and the USSR to address the impact of humans on earth’s climate. This collaboration led to the Nuclear Winter theory, according to which a thermonuclear conflict could cool down the Earth’s temperature to such an extent to alter the biological processes as well as the geological components of the planet. In 1982, the ICSU established a Committee for the Assessment of the Environmental Consequences of Nuclear War under SCOPE’s supervision. The Commission was called to report on the effects of the nuclear warfare on the biosphere, however, in 1985, climate modelling for the NW started to be criticised by the US authorities being subjected to extensive smear campaigns interfering with SCOPE scientific findings. This paper explores the work of the ICSU in supporting research for the protection of the planetary environment, at the same time, mediating with growing political pressures pointing out the needs for incrementing security strategies and nuclear state expansion. This examination allows us to explore the network of interests and limitations underlying environmental cooperation that are notoriously geopolitical and military. Furthermore, it allows to evaluate what kind of scientific internationalism informed the role of SCOPE, which shaped research on the Earth-system modelling in Cold War times.

**Models in Biochemistry: How in Vitro Biotechnology is Used to Know the Molecular World**

Erica Dietlein  
*University of Nevada Reno*

In vitro systems are commonly used within the fields of molecular biology and biochemistry. However, despite the prevalent use of these systems, discussions
regarding the nature of in vitro modeling have thus far been limited, and do not capture the diversity of in vitro modeling techniques employed by biochemists. The nature of modeling in molecular biology and biochemistry is more diverse than it initially appears, and much of the modeling done within these fields remains unexplored by philosophers. In my talk, I will briefly introduce one means by which biochemists have used in vitro studies to generate knowledge about molecular activity, citing studies from 2012 used to characterize the mechanisms behind the CRISPR-Cas9 system. Furthermore, I will gesture to where the philosophy of chemistry and the philosophy of biology might be brought together to better address questions about modeling in biochemistry.

**Moral Agency of Infants in Child-Rearing Manuals and Infant Pedagogy of Pre-Darwinian Nineteenth-century America**

Elisabeth Yang  
*Rutgers University*

Sally Shuttleworth, in *The Mind of the Child*, marks the publication of Darwin’s *Origins of Species* in 1859 as a point in which the view of children as those “on par with the animal kingdom” informs the psychological treatment and literary depictions of children.[1] A shift occurs in theories of child development that previously analogue children to gardens to that of brutes and machines. Medical and religious discourse concerning the moral agency and status of the infant shifts as child-rearing and motherhood become more ‘scientific’ and specialized during the late nineteenth century and a sort of fragmentation of the infant, a separation of the physical, mental, and moral features of the child and discourse of the moral agency of infants wanes. With this project, I aim to uncover the moral imagination of infants in a period in pre-Darwinian America and consider its prevalence or dissolution in contemporary discourse on the moral agency and personhood of infants. Secondary to my project is the exploration of the various medical, philosophical, scientific and religious influences that molded particular conceptions of the infant as rational and moral. Untangling the interwoven threads of religious and philosophical discourse prior to the emergence of the evolutionary thought and scientific child psychology can shed light on alternative ways in which we might conceptualize infants as moral agents and address the problem of agency in general. 1. Sally Shuttleworth, *The Mind of the Child: Child Development in Literature, Science, and Medicine, 1840-1900* (Oxford: Oxford University Press, 2010), 181.

**Mutant Sexuality: The Private Life of a Plant (and Those who Studied It)**

Luis Campos  
*University of New Mexico*

Our modern ideas of biological mutation date back to 1901, with the creation of a “mutation theory” that held that new species could arise from parent species in the space of one generation, in a sudden evolutionary jump. The first organism thought to provide evidence for this view, an evening primrose, was later discovered to have chromosomes demonstrating unusual behavior—they would link up in rings rather than pair two by two. The validity of the mutation theory came into question as this behavior was labeled a "degenerate" form of reproduction, "subsexual" or even "queer." Intriguingly enough, however, the same sorts of terms might well have been applied to the men who studied this plant, and who defended its reproductive peculiarities as novel and productive modes with great evolutionary potential. How can knowing the intriguing details of the private lives of these scientists aid a historical investigation of cytogenetics in the early twentieth century? Is the ability to recognize the reproductive value of novel mutants created by queer chromosomal dynamics related to the private lives of those doing the studying and explaining? In other words, is there a connection between the mutant gazes-and the mutant gays? In this talk I will explore the possibility of using sexuality as an analytical lens in the history of science, and will suggest that not only did this plant disrupt assumptions of sexual behavior--
it might even be seen as challenging our categories of "sex" and "species" altogether.

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**MYCIN Explains Itself: Computing, Authority, and Trust in American Medicine**

Andrew Lea  
*University of Oxford, Max Planck Institute for the History of Science*

In the early 1970s, the young MD-PhD student Edward H. Shortliffe started work on his dissertation within Stanford University’s Department of Computer Science. His PhD thesis, completed in 1975, involved the development of a computer program called MYCIN, an early expert system that aimed to furnish advice concerning the diagnosis and treatment of bacterial infections. MYCIN immediately attracted wide attention: it matured into a much larger research enterprise at Stanford and spawned larger conversations about whether and how to apply computers to the problem of medical diagnosis. This paper recounts this early effort to computerize medical diagnosis and decision making. It pays particularly close attention to the interrelations among computing, authority, and trust. How could a physician using the system know that its advice was accurate and trustworthy? What did the developers of MYCIN do to make the system’s reasoning comprehensible to its human users? If the system’s advice could not be understood, what perceived implications would that have for the physician’s status as the ultimate decision maker? Such concerns about trust, authority, and comprehensibility animated both the development of and the responses to MYCIN. As artificial intelligence and machine learning are increasingly integrated into modern clinical care, these concerns endure today.

**Myth-Historical CRISPR Edits: Emerging Histories and Contested Futures**

Jose Perillan  
*Vassar College*

According to Physicist Leon Lederman, scientific myth-histories are not intended to be historically accurate. Instead, they serve as pedagogical devices that filter out unwanted historical details and noise. By filtering out this noise, myth-historians hope to perpetuate an essentialist idealization of science. In practice, these narratives are not passive filters of anachronist noise. They are active rhetorical agents that serve to project community ideals, filter out unpopular scientific ideas, help establish consensus, and further particular scientific agendas. In January 2016, Eric Lander of the Broad Institute of MIT and Harvard wrote an article for Cell entitled “The Heroes of CRISPR” in which he gives a short historical account of the development of this revolutionary genetic editing technology. Read as such, and without an understanding of the broader context of innovation surrounding CRISPR-Cas9, his audience might accept this account as a factual representation of scientific development. However, when read as part of a controversial patent dispute between academic heavyweights Jennifer Doudna at U.C. Berkeley and Feng Zhang at the Broad Institute, this historical narrative begins to reveal itself as a clear case of myth-historical propaganda. In his account Lander significantly downplays Doudna’s contributions, choosing instead to highlight the efforts of his colleagues at Broad. Doudna has since published A Crack in Creation detailing her own myth-historical version of the development of CRISPR-Cas9. The following analysis unpacks the various emerging myth-histories of CRISPR-Cas9, and contextualizes their various uses and impacts as scientists and institutions vie for scientific recognition and patent control.

**Natural Law Theodicy and Liberal Christianity in the United States**

Kristin Johnson  
*University of Puget Sound*

This paper examines the historical relationship between theodicy and science, with particular attention to Unitarianism in the United States. It focuses on how scientists and theologians appealed to a particular version of theodicy (natural law theodicy,
an explanation of evil that appeals to the goodness of natural law, despite accidental suffering that might result from, say, two laws coming into conflict) both to defend science against its critics and to reconcile belief in natural law with their religious faith. The paper argues that the role of diverging theodicies is worth considering as one of many important sources of divergence and conflict between various versions of Christianity and the relationship between science and religion in the twentieth century.

**Negotiation and Development in Latin America: Science, Medicine, and Technology in the Western Hemisphere**

Steve Server  
*University of Chicago*

In 1967, Enzo Faletto and Fernando Henrique Cardoso published their classic work Dependency and Development in Latin America. "Western" investment, far from placing Latin American nations on a path to progress, had created dependent nations struggling to chart their own path, stunting attempts at autonomous development. At the same moment, Science published George Basalla's "The Spread of Western Science." "Colonial science has its drawbacks," Basalla wrote, "but it is in the fortunate position of being able to utilize the resources of existing scientific traditions while it slowly develops a scientific tradition of its own."

In this panel, we hope to better elucidate the relationship between the politics of development and "Science at the Periphery." We underscore the unique nature of scientific enterprise in the twentieth century, stemming from processes of negotiation between "Western Science" and local actors: the stories we tell about a diverse range of Latin American experiences show that science has not been the product of a graft, but of centuries of coevolution between foreign and local epistemological traditions. We hope our answer to this traditional debate advances an understanding of the developmentalist role of science in the region. How did the priorities for applied science set by the region’s various actors speak to their anxieties and hopes about the prospect of becoming culturally, economically, and politically independent polities in the twentieth century? How did debates in the scientific arena resonate with broader debates about national representation and citizenship, market and state interactions, and regional self-determination?

**Newton the Alchemist**

William Newman  
*Indiana University*

The subject of Isaac Newton’s alchemy has raised varying degrees of controversy since the 1936 Sotheby’s auction that made it widely known to the public. Thanks to the sudden availability of about a million words on alchemy written by the famous physicist over a period of some thirty years, the economist and amateur historian John Maynard Keynes was able to assert that Newton was not the first of the modern scientists, but rather the last of the magicians. This startling new view led to further questions. Was Newton’s alchemy a vehicle for his Antitrinitarian Christianity? Did he derive his belief in immaterial forces from his alchemical research? Did Newton actually believe that the corpus of mythology descending from the ancient Greeks and Romans consisted of encoded alchemical processes? And finally, what was he actually doing in the laboratory? Was he merely reproducing the work of previous alchemists such as the American emigré George Starkey, or was Newton doing original chymical research? Over the last decade and a half, the Chymistry of Isaac Newton (www.chymistry.org) project has been editing Newton’s alchemical writings and attempting to replicate his products in the laboratory. As a result of this ongoing effort, we are now in a position to address the many questions raised by Newton’s alchemy. The present talk gives an overview of William Newman’s research on Newton’s long chymical endeavor, which addresses these questions and others.
Paleoecology, which studies environmental change through geologic time, often made predictions about ecological change by comparing the changes experienced by vegetation communities in the past with similar changes facing modern communities. The modern analog method, which relied on these comparisons and was developed by G. Evelyn Hutchinson in the 1930s, became the linchpin of the field. But what happened to a scientific field when anthropogenic climate change threatened the main way that paleoecologists understood the past and future? This paper explores this question first by examining Hutchinson’s method and then examining how paleoecologists modified the tools of their profession in an era of global change when they encountered “no analog situations,” moments when the present did not look anything like the changes experienced in the past. The crisis that no analog situations presented led to broader discussions about the purpose of deep time in studying environmental change, which I take up in the second half of my paper. With no analog situations, I argue that paleoecologists were forced to admit that “history is better suited to providing cautionary tales rather than specific images of future climate and vegetation change.” The predictive power they had claimed by knowing the deep past faded in an era of global change.

**Noise in the System: Recording and Erasure in Mid-Century American Dance**

Whitney Laemmli
_Columbia University_

In the early 1940s, a New York City organization known as the Dance Notation Bureau (DNB) began a decades-long effort to promote a system known as “Labanotation.” Using a combination of shapes, shading, dots, and lines on a eleven-column vertical score, Labanotation was designed to capture the ephemeral, three-dimensional complexity of dance on the flat surface of paper. Eschewing notions that dance was too emotional, evanescent, or complicated to be documented, the women who ran the DNB saw the moving body as swarming with potential data points. To them, a dance was information, and—with the right system in place—that information could be “objectively” and “scientifically” recorded. Doing so would catapult dance into the modern era, finally freeing the field from its “primitive” and “illiterate” past.

Focusing on the period between 1940 and 1975, this paper catalogues the DNB’s efforts to record and preserve movement, and explores how these efforts contributed to broader transformations in the definitions of creativity, preservation, authorship, and dance itself. In particular, it argues that the DNB ironically promoted a vision of dance in which dancers were conspicuously absent. Reduced to mere noise in an otherwise rationalized recording system, dancers’ individual expression became a difficulty to be solved rather than an integral aspect of the creative work. They were, to borrow a phrase from information theorist Claude Shannon, simply “statistical and unpredictable perturbations,” distorting the transmission of dance’s clear signal, a view that drew on deeply gendered and raced conceptions of human creativity.

**Nurturing Chinese Physicists at Yenching University: The Contributions of the Rockefeller Foundation and American Physicists**

Danian Hu
_The City College of New York_

This paper explores the founding and early development of the department of physics at Christian Yenching University in Peking (Beijing). It shows how this small physics department evolved into a major cradle of physics researchers in China over the period of the 1920s and 1930s. It will demonstrate the indispensable contributions from the Rockefeller Foundation and American physicists, such as William Warren Stifler (1883-1954), Charles Hodge Corbett
(1881-1963), and Paul Alexander Anderson (1898-1990), to the growth of the physics department as well as the advancement physics research and education in Republican China.

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**Observing the Inner Life on Stage: Goethe and the Beginnings of the Weimar Court Theater, 1791-1798**

*Ashley Clark*

*University of Chicago*

This paper explores the relationship between Goethe's theater praxis and his early experiments on light and color throughout the 1790s. The paper first describes the inception of each endeavor: (1) Goethe's debut as stage director of Weimar's court theater on May 7, 1791 - a role that would last a quarter of a century, and (2) the defining moment occurring just ten days later, as he stood by his window alone, looked through a glass prism and suddenly saw the "true law" of color. This moment not only instigated innumerable experiments but also required Goethe to define, and later revise, his own experimental method of observation. The paper illustrates a decisive shift in Goethe's judgment of German theater from something "mechanical" and "frivolous" in the early 1790s into something with "an inner life," worthy of epistemic value after 1796. The swing parallels two aspects of his experimental work on optics. First, it reflects the language used in his polemic against "mechanical" explanations for light and color. But more significantly, it corresponds to a significant modification of his experimental method of observation between 1792 and 1798, when he began to relax the boundaries between scientific objects and artistic efforts. This paper traces how Goethe unbolted his experimental method from scientific observation and began to apply it to theater, validating the stage as a site for knowledge production. Finally, it discusses the significance of both rules and riddles as intrinsic to performing an experiment both

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**Of Patient Pigeons and Impulsive Humans: Choice over Time in Psychology and Economics since 1960**

*Will Deringer*

*Massachusetts Institute of Technology (MIT)*

Buy the flashier car or save more for retirement? One marshmallow now or two in fifteen minutes? In the 1960s, the question of how people make decisions across time became a guiding research problem in the social sciences, following two notable trajectories. Economists like Tjalling Koopmans sought to develop a formal-mathematical model of intertemporal choice that could be derived from basic axioms of rational behavior. Simultaneously, psychologists working in the behaviorist tradition, notably Richard Herrnstein—who took over leadership of the famed Harvard Pigeon Laboratory from founder B. F. Skinner in the early 1960s—and Pigeon Lab member George Ainslie, sought to understand inter-temporal behaviors like "impatience" and "impulse control" as measurable empirical phenomena, with pigeons as models. Researchers in both fields contended that the present/future trade-offs humans—and other animals—make could be rendered by a mathematical function. For the economists, this "discounting" curve was exponential, coinciding with the practical compound-interest mathematics long used financiers, actuaries, and engineers. For the psychologists, informed by Herrnstein's behaviorist "matching law," this curve was hyperbolic, indicating that animals/humans tended to discount the near-future more heavily than the distant-future. Beginning in the 1980s, the economic and psychological strands began to entangle, and choice over time became a foundational problem in an emergent "behavioral economics." As previous scholars have noted, this interdisciplinary encounter entailed a clashing and (incomplete) reconciliation of different methodologies, epistemic values, and conceptions of human nature. It also involved another, less noticed, boundary-crossing: the emergence of non-human animals as economic actors.
This presentation examines the effects of the contraceptive technology known as the Ogino-Knaus or rhythm method on the debate about contraceptives and law in early twentieth-century America. In 1924, the Japanese gynecologist Kyusaku Ogino presented his theory on the timing of ovulation. This was immediately applied as the Ogino-Knaus/rhythm method of contraception, in which knowledge of the time of ovulation is supposed to enable avoidance of conception through abstinence. In a sense, women’s calendars were redefined as contraceptives. As the pope was deemed to have allowed use of the method, Catholics quickly welcomed it. The American Catholic doctor Leo Latz published a book on Ogino’s theory and introduced a contraceptive calendar. Latz’s calendars were then circulated, effectively sidestepping the Comstock Act, which banned the distribution of contraceptives through the mail. Birth Control League of Massachusetts, which fought against the Comstock Act and the related Massachusetts state law, appeared embarrassed by the situation at first, but then they sought to turn it to their advantage. Thus, the Ogino-Knaus/rhythm method acted as a stepping stone to attacking the restrictive laws.

Translation was an important practice to the Old Babylonian scribe. It allowed a scribe to move between mathematical cultures, and it allowed the scribe to cross between systems of expression in a single culture. The word “translate” is used in this context to denote a change in numerical expression, not to be mistaken for a change in numerical or measurement value, nor to be understood as a modern translation of an exclusively verbal text. What could constitute this change in representations? Were there rules associated with numeric translation? Why did it need to occur? This article will explore these questions by focusing on three examples of translation witnessed in Old Babylonian texts. First, it will focus on the translation of numbers between a base sixty system, common to the Old Babylonian southern Mesopotamia, and base hundred, common to northern Old Babylonian Mesopotamia. Second, the very shape of numbers on a text will help delimit translation of numbers from a mathematical environment to an economic environment. Finally, these same base sixty numbers were routinely translated from mathematical thought directly to measurement systems, which meant to express values using metrological tables of transformation memorized in the early elementary phase of their schooling. In this way, it will be seen what happens when a scribe translated values between systems, between different media, including material objects, and how they coped with translations before any rules to define translation came into existence.

The standard Peripatetic view considers the primary qualities as constitutive, with the matter, of the substance of the body. Accordingly the only qualities responsible for any change are the four primary ones: hot, cold, moist and dry. However, properties of bodies like magnetic attraction are non-sensible powers that cannot be explained solely from the mixture of primary qualities. Such specific properties (khāwaṣṣ) would be the observable but unexplained physical manifestation of a specific power proper to some mineral, animal or plant. They can be observed but not deduced rationally. Of course alchemy made considerable usage of such properties or powers, but medicine also used the same notion extensively, especially in pharmacotherapy. Galen already
acknowledges the phenomenon, distinguishing between drugs that act through their elementary qualities and those that act “through the peculiar property of their entire substance” without further explanation. The problem, which is at the intersection between medicine and natural philosophy, was precisely how to provide a causal explanation for the properties of a drug that apparently do not result from a mixture of the primary qualities. It will however receive much greater prominence in Avicenna’s medico-pharmacology that shifted the emphasis towards an empirical, non predictable model, relying solely on experience (McVaugh). This paper will examine some responses to Avicenna in the Arabic medical literature at the turn of the thirteenth century aiming at restoring a more speculative approach based on a causal and scientific explanation in terms of the primary qualities within Aristotelian physics.

Organisms without Borders: Transnational Travel Stories of Practices, Data, and Standards

Rachel Ankeny
University of Adelaide

As well-documented in the history of biology, organisms have been used as experimental systems or even models to study a range of phenomena. This session goes beyond existing accounts to explore how various practices, data, and standards associated with use of many organisms have been articulated, negotiated, and evolved, using a series of contemporary case studies based in a variety of locales. The first paper examines neglected issues associated with the emergence of ethical standards for animal research in Australia, exploring the changing use of key concepts to excavate the influences of other Anglophone systems. The second paper utilizes novel visualization techniques to examine broader and local trends in organism use in developmental biology in the 1950s-1960s, thus permitting closer attention to contingencies that underlie continuities in organismal choice and to identify and investigate changes in biologists’ practices. The third paper analyzes challenges related to devising methods for sharing crop phenomic data across different international locations, including high-resourced and low-resourced research environments and different types of sites such as laboratories, experimental farms, and plant stations. The final paper investigates how non-standardized animals have come to be key experimental organisms for studying influenza, and how diverse global communities have articulated and negotiated experimental standards for working with them and making findings applicable to humans. A commentary from a biologist with extensive publications in history/philosophy of science will both deepen these historic reflections and promote dialogue between the papers.

Origin of Forms and Qualities: Robert Boyle’s Reply to William Harvey

Ashley Inglehart
Consortium for the History of Science, Technology, and Medicine

This paper looks at famed chemist (or chymist) Robert Boyle’s Origin of Forms and Qualities and considers an un-named target of Boyle: William Harvey. Boyle published Origin of Forms and Qualities in 1666 as an attempt to eliminate reliance on Aristotelian forms, promoting instead his own corpuscular philosophy. In “The Historical Part” of Origin of Forms and Qualities, Boyle provides examples and experiments historically understood as involving substantial change, which he attempts to describe in terms of quality-less, uniform corpuscles. His very first example involves the hatching of an egg, or the development of a chick from diaphanous fluid. This paper argues that Boyle’s use of this example – from his introduction of it, to his description of how the egg develops, to his concluding remarks regarding the explanatory power of Harvey’s “plastick principle” – is a direct response to Harvey. Harvey had communicated his own views on the generation of chick eggs some fifteen years prior in Exercitationes de Generazione Animalium. A detailed analysis of his reply to Harvey can allow us to understand not only Boyle’s own account of animal generation but his methodical commitments more generally. Harvey
holds that proper explanation lies in an account of the four Aristotelian causes, and his description of the plastic principle within the chick-egg is closely tied to his account of those causes. Boyle, however, rejects this approach and places the explanatory focus upon the material effects and modes of operations.

-Originating the Microbiome: Joshua Lederberg and Microbiology's Self-Narration at the Advent of the Human Microbiome Project-

Melissa Wills
UC Davis

This talk focuses on the emergence of the term microbiome in the early 21st century, a rhetorical phenomenon that helped to legitimize the nascent field of human-microbial genomics as scientists advocated for the development of the multi-year, multi-site, $115 million Human Microbiome Project. The term had long been in use by microbial ecologists to describe a self-contained microbiological community. Yet when it emerged in 2001, referring instead to a collection of microbial genomes, scientists declared it a neologism, entirely overlooking its earlier usage. My presentation surveys a range of scientific publications from the late 1990s and early 2000s, showing how scientists began to attribute the microbiome concept—through a series of misquotations and erroneous citations—to Nobel laureate Joshua Lederberg. I argue that this narrative served both to represent the novelty of microbiomics as a discipline and to claim a rhetorical stamp of approval from an elder statesman. In borrowing Lederberg’s authority, alongside similar borrowings from Pasteur, Leeuwenhoek, and other central figures, scientists re-narrated scientific history to establish microbiomics as both new and as prophesied by revered figureheads. I conclude with a brief discussion of scientific pushback against this origin story in the wake of the media frenzy that followed the release of the HMP’s first publications in 2012. Taking on the roles of amateur historians and literary scholars, a number of scientists have turned to historical scientific documents to contest Lederberg’s visionary status, critically interrogating science’s discursive practices in an effort to tell a more measured story.

-Owning the Evidence: The Lasting Controversies of Early Primatology Filmmaking-

Benjamin Schultz-Figueroa
University of California, Santa Cruz

“Owning the Evidence: The Lasting Controversies of Early Primatology Filmmaking” traces the unusual history of intellectual ownership over a groundbreaking collection of early comparative psychology films. From 1913-1917, the psychologist Wolfgang Köhler shot 6 reels of film depicting his experiments into ape cognition at an Anthropoid Station in the Canary Islands. Köhler believed that the moving image produced insights into the minds of nonhuman animals, allowing scientific observers to objectively empathize with the onscreen apes by documenting their gestures and expressions. But, as theories of behavior changed, so too did the meaning of these recordings. Behaviorists such as Clark Hull, Robert Epstein, and B.F. Skinner rigorously criticized Köhler’s interpretation as a projection of interiority beyond what the science could prove. In an attempt to demonstrate how the moving image might lead to consistent misreadings of animal behavior, Skinner and Epstein produced several filmed experiments in 1982 that reenacted Köhler’s films using pigeons instead of apes. These reenactments were meant to illustrate the limits of cinema as a scientific tool for revealing profilmic truths, but they also demonstrate the plasticity of scientific providence, in which a film’s meaning changes alongside scientific theories. Within this context, I argue that “ownership” did not refer to the material possession of a film or its patent, but rather to the power to define the discourse through which a film’s images would be seen.

-Pascual Jordan, the Cold War, and Remembrance of Nazi Pasts-

Ryan Dahn
University of Chicago
Few topics in history of science have attracted as much scholarship as the birth of quantum mechanics in the 1920s. Yet despite the near-obsession with all things quantum, one of the major architects of this famous theory is largely forgotten: the brilliant German mathematical physicist Pascual Jordan (1902-1980), who in collaboration with Werner Heisenberg and Max Born, outlined the fundamentals of quantum theory. The reason Jordan is rarely remembered today is commonly attributed to his Nazi-era writings that praised Hitler’s regime; an unrepentant fascist hardly fits into the usual heroic narrative of scientific triumph.

This paper delves into the question of Jordan’s remembrance, and argues that Jordan has gone down in historical memory as a villain not, as has been thought, exclusively because of his pro-Nazi statements during the Third Reich, but in large part due to his decision to reenter politics in the late 1950s. It was only then that Jordan viciously attacked colleagues in physics who spoke out against possible West German nuclear armament, deriding them as naïve fools. Stridently supporting Konrad Adenauer’s Christian Democratic Union, Jordan was elected to the West German parliament. Yet his colleagues responded by unearthing and disseminating Jordan’s writings from the Nazi period, exposing them to a new postwar audience. Without relativizing Jordan’s decisions and writings during the Third Reich, I demonstrate that actions taken long after Hitler’s death have often dictated who is collectively remembered as an “unapologetic Nazi.”

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**Performing Authenticity: The Making-Of-Documentary in Wildlife Film’s Blue-Chip Renaissance**

Eleanor Louson
York University, Canada and Michigan State University.

21st-century wildlife films promote authenticity through the extensive use of making-of-documentaries (MODs), showcasing filmmaker trustworthiness and innovations in filmmaking practices and equipment. MODs have a long and understudied history, evolving in parallel with feature films. Enjoying recent prominence as promotional trailers, bonus features on DVD releases and websites, and televised segments within wildlife broadcasts, MODs work to make public the practical and technical conditions of wildlife film production to an unprecedented degree. This talk explores MODs’ contribution to a transformed public representation of natural history, and how the digital media landscape affords filmmakers new modes of performed transparency which contrast with previous MODs’ stance of “claimed artificiality” as described by Gouyon (2016).

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**Perfecting the Body in Premodern Europe**

Bradford Bouley
University of California, Santa Barbara

Concern with the body, both human and animal, animated natural inquiry across the medieval and early modern periods. This panel brings together historians of premodern science and medicine in order to explore the ways in which definitions of the ideal body were socially constructed, received, enforced, and resisted. Focusing on Europe in the late medieval and early modern period (roughly 1300 to 1700), we collectively explore theories and practices of embodiment and bodily modification, from gender-modification surgery in medieval Europe, to animal breeding and theories of inheritance in Spain and New Spain, from nutrition and Reformation in Baroque Rome, to speculations about the detrimental impact of the human body on the global environment in Renaissance Padua. We seek to uncover the social, political, intellectual, and religious forces behind these attempts to remedy perceived imperfections in human and animal bodies and to render them better adapted to the demands of agriculture, empire, religious uniformity, and patriarchy.

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**Perry H. Charley: Translating the Disruption of Hozho**

Linda Marie Richards
Oregon State University
Perry H. Charley’s life illustrates translation as an act of healing. He is entwined with the American quest for nuclear supremacy through uranium. Like many other Native Americans, Charley was sent to boarding school as part of the U.S. government and Bureau of Indian Affairs efforts to assimilate Indians. At Shiprock Boarding School his hair was cut off, and he was treated with insecticide against lice. “I was told to never speak my language again, but I sit here today as a fluent-speaking Navajo,” Charley says. “To repair as best I can what was lost, that has been my life’s work.” His father died young as one of the thousands of unprotected uranium miners sacrificed in the building of the first nuclear weapons and the uranium economy. Perry later discovered the cause of his father’s death as respiratory failure from fibrosis of the lung. It was a disease with which the Navajo had no experience and thus, no vocabulary. There are no Dîné words for radon progenies and radioactivity, or for alpha and beta particles, or gamma radiation. But Charley is changing that with a painstaking effort to create a glossary, constructing new Navajo words for radiation-related terms. In his published work he translates in the opposite direction to re-inscribe his traditional culture’s way of seeing harm from contamination to show that health physics is not inclusive of spiritual, mental and physical health.

Contraceptive technologies, particularly those that rely on monitoring or calculating methods, embody an essential tension between the standardizing impulse of modern medicine and, personal knowledge women have used to control their own fertility. As with prior contraceptive technologies, the rhetoric of the patent adopts Western imperialist anxieties over global population control and relies on perceptions of “natural” methodologies of contraception as inherently moral to sell this modern medical technology to world governments.

This paper uses this patent as a case study in the complex history of contraceptives as it relates to the medicalization of women’s bodies. The positive fertility testing patent is one example of the ways that contraceptive technologies are much more than simply liberatory medical innovations. These technologies are designed to operate on multiple scales that encompass both medical imperialism through the export of tools for Western scientific vision and social movements for women’s liberation through the production of knowledge about their bodies.

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**Personal Practices: Contraceptive Technologies and Scientific Vision**

Anna Reser
*University of Oklahoma*

This paper examines a 1998 patent for a “Positive fertility testing and reproductive health system,” which consists of what is essentially a handheld microscope for women and men to examine small samples of their bodily fluids to determine fertility. This patent describes a reproductive technology that encourages the user to engage in making observations, collecting data, and interpreting data about their bodies to make decisions about reproduction. This patent draws on the rhetoric of the women’s health movement of the 1970s to frame this technology, and the personal scientific practice that it encourages, as liberatory.

**Personified Instruments: Translating Instrument Names in 18th-century France**

Ion Mihaiescu
*Max Planck Institute for the History of Science, Berlin*

This paper reconstructs the historical practice of naming scientific instruments through the composition of Greek and Latin roots so that the name of an instrument could serve a self-definition and description of its role and function. Following the use and translations of “pantographe” and “météorographe” in the institutional practices of 18th-century France, the paper shows how the method of naming scientific instruments with the Greek root "graph" was first established in European
scientific culture. By closely analyzing the etymological translations of the root “graph” within different institutional and non-institutional environments (as opposed to assuming an ahistorical absolute meaning which can be recovered through a dictionary definition), the paper proposes a methodological and functional reinterpretation of the late-18th and early-19th century "graph-instruments" as instruments whose perceived purpose in scientific process was that of describing natural phenomena, rather than inscribing data into archives. While the initial role and function of an instrument might have been viewed according to its name derived from vernacular translations of the Greek roots, as the instrument was moving across geographical boundaries, social groups, historical timelines, and institutional contexts, the translation and interpretation of its name and function was also altered to adjust to its volatile designations and capacities.

Phenomic Data between Local Fields and Global Databases: Developing Labels for Field Data Collection, 1990-2016

Sabina Leonelli
University of Exeter

The study of plant phenomics in the field involves complex efforts of data collection and analysis. There are countless parameters of potential relevance ranging from the information about the soil, relevant microbiomes, plants at different stages of development, changing climatic conditions and so forth; and no universal approaches to identifying and labelling relevant traits. This paper investigates attempts to share phenomic data about crops across different locations, and particularly between high-resourced and low-resourced research environments. I focus on the Crop Ontology, a digital infrastructure that was developed by an international network coordinated by researchers in Montpellier over the last decade to facilitate the sharing of information between plant scientists working in laboratories, experimental farms and plant stations in Europe, the United States, South America, Sub-Saharan Africa and various Eastern countries. I document the development of the Crop Ontology in relation to CassavaBase and YamBase, two “open” databases used to data from field trials carried out in West-Africa. On the basis of archival sources and interview material from the International Institute of Tropical Agriculture in Ibadan (Nigeria), I discuss how Crop Ontology curators confronted challenges relating both to the diversity of tools, terminologies, and variables used to describe widely diverse species in different parts of the world, and to the differences in expectations, goals, and working conditions among researchers and technicians involved in efforts of data collection.

Philology on (and off) the Clock: The Case of the Thesaurus Linguae Latinae

Christian Flow
Princeton University

For all time or for the moment? This paper considers two opposed temporal “modes” or “idioms” in the work of turn-of-the-century philologists: one dismissing the clock (and the calendar) and orienting itself towards the eternal and unbounded, the other embracing the budget and deadline, calibrating itself to the stroke of the hour and the passage of the year. Focusing on the Thesaurus linguae Latinae, a monumental Latin lexicon begun in Germany in the 1890s and still in progress today, I will ask how these opposed currents are reflected both in the shape of one of the era’s characteristically ambitious philological enterprises and in the quotidian realities of the scholars who worked on it. Engaging larger questions about what kind of scholarly work could and should be done on the clock, the tension between extra-temporal designs and measured règlement had stakes not just for planning and publicity around the Thesaurus, but also for the careers of philologists associated with the project, the disposition of their daily work, and the assessment of their results.

Philosophy, Orientalism, and the Invention of “Eastern Wisdom”
In Paris on September 21, 1827, Europe’s most famous philosopher and France’s first professional sinologist met to discuss the intellectual traditions of China. The sinologist, Jean-Pierre Abel-Rémusat, lauded the “ancient oriental doctrine” of Daoism, which he claimed had been known to all the peoples of the pre-Christian world. The philosopher, G.W.F. Hegel, accepted that Daoism was the fully realized expression of Chinese thought—but for him, it was not philosophy at all, only a “developed religion of magic.” This marked the end of a transformation in European engagement with the China. Just a generation earlier, the philosophes of the French Enlightenment had looked there for familiar models of Confucian reason. How, then, had China become a location of exotic alternatives of Daoist wisdom? In this paper, I argue that professional sinologists and philosophers together built their idea of sagesse orientale, or “eastern wisdom,” on the foundations of the Jesuit missionaries’ search for divinely-inspired prisca sapientia, or “ancient wisdom,” reworked through the interpretive lens of the late Enlightenment. If the Enlightenment ended with the disenchantment of the West, it also led to the enchantment of the East. In this way, China posed new questions that independent academic disciplines including both philosophy and orientalism were set up to answer. Both exponents of progress and admirers of the past converged on the idea of a monolithic East as an enchanted and ancient land, incommensurate with the modern West.

Physiology, Psychology, and Music Pedagogy: Regimes of Musicality in Germany at the Turn of the Twentieth Century

Joshua Navon
Columbia University

Recent research has highlighted a flourishing of exchange between the musical and scientific fields of nineteenth-century Germany, with discussions of Hermann von Helmholtz’s writings on music and the psychophysics of listening featuring especially prominently (Jackson 2006; Steege 2012; Hui 2013). This paper outlines a related but little-discussed aspect of this interdisciplinary history. In the decades surrounding the turn of the twentieth century, a group of German professors of music, situated primarily in the newly dominant music conservatories, drew from developing knowledges in physiology and psychology to reformulate and expand prevailing conceptions of musical capacity. Drawing from archival research at Berlin’s Universitäten der Künste as well as contemporaneous music education journals and other published materials, I discuss how even the most apparently simple of musical actions (playing a single note on the violin, perhaps) came to be seen as demonstrating a remarkable multiplicity of physiological and psychological processes. In response, new emphasis began to be placed on “musicalizing” young students through elementary studies in perceiving and producing musical movement, rhythm, tone, dynamics, and phrasing. Furthermore, both conservatory curricula and journalistic discourse placed new value on musical practices that required transducing between distinct media (such as music dictation, which transduces the reception of auditory information into the production of its written representation). By way of conclusion, I analyze how these attempts to define musicality anew—its norms, potentialities, and pathologies—were entangled with the pedagogical practices of training and examination through which that very musicality was developed and assessed.

Placing Post-Cold War Physics: Attempts by Laser Interferometer Gravitational-Wave Observatory to Site Gravitation Physics on Military Sites

Tiffany Nichols
Harvard University

This paper explores how physicists of the Laser-Interferometer Gravitational Wave Observatory (LIGO) attempted to locate their research on military sites, LIGO’s negotiations with the administrators of these sites such as the U.S. military, and LIGO’s response to claimed national security concerns tied to the sites. As the Cold War wound down,
governmental and military sites active during the Cold War were either abandoned or use of the sites restructured or reduced and in many instances placing them in the holdings of the Bureau of Land Management. In addition to exploring the unaddressed history of LIGO’s site selection history and analyzing LIGO’s experience with consideration of placement of a large-scale interferometer within military sites and decommissioned spaces, this paper will also explore how the Cold War history morphed such sites into technical landscapes. Specifically, this paper will show that in the case of LIGO, these spaces were originally considered because they were perceived as wilderness or public land available to conduct nationally funded basic research and inexpensive due to government ownership of the land. However, in trying to locate their research, LIGO learned that the sites were heavily regulated and controlled by remnants of the Cold War. Thus, this paper concludes that although government lands may be less costly, such land may be nonetheless difficult to access due to each party’s perceived administrative roles the land.

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**Planetary Designs: The Historical Intersection of Geoengineering and Terraforming**

**Daniel Zizzamia**

*Harvard University Solar Geoengineering Research Program*

In 1995, dental surgeon-turned-planetary scientist and terraforming expert Martyn J. Fogg authored the seminal “technical-level” book on the history, science, and prospects of “engineering planetary environments.” In this book published by the Society of Automotive Engineers, Fogg categorized geoengineering as a subset of terraforming. In 2000, geoengineer David Keith noted that terraforming and geoengineering “are linked by commonality of proposed technologies, ethical concerns, and by their ambiguous position between the realms of science fiction and reasoned debate about human use of technology.” In 1997, the notorious nuclear physicist Lowell Wood co-wrote an influential geoengineering thought-piece. Recently, Wood has revealed that geoengineering Earth is simply “the first stop” in his grander ambition to terraform the Red Planet. Wood proclaimed, “It is the manifest destiny of the human race!” It is this harmony between what has been collectively referred to as “planetary engineering” that suggests the need for pursuing their roots and intersections. At present, these are what some would consider fringe sciences that are often cast at best as fantastically utopian and at worst as products of the deranged minds of mad scientists in the mold of Dr. Strangelove. By examining their shared history and overlapping research questions we can come closer to a more fruitful dialog that simultaneously takes their fictive origins seriously and emphasizes the cutting-edge science behind planetary engineering. Only then can we properly address the ethics and socio-political implications of planetary engineering.

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**Plant Exchanges and Imperial Reform: Founding a Botanic Garden in New South Wales, c. 1820**

**J’Nese Williams**

*Stanford University*

In the nineteenth century, the British government supported the creation of botanic gardens throughout the empire, with over one hundred in existence by the century’s end. Colonial garden superintendents were expected to identify and cultivate economically and medicinally valuable plants and take part in global networks of plant exchange. As scientific institutions, the colonial gardens were sites for producing and disseminating plant knowledge. These practices placed the gardens within an imperial system directed toward profit and “improvement.” The superintendent at the Royal Botanic Gardens, Kew, became the de facto head of this system after Kew transformed from a royal to a national garden in 1841. The proliferation of colonial gardens suggests that the British government increasingly turned to them to handle a range of botanical projects. However, these services could have been delivered by other means. This paper takes a closer look at the establishment of a botanic garden in New South Wales to explore why a garden might be founded in a
colony where government officials and private individuals were already acclimatizing, collecting, and exchanging plants. Scanty documentation on the garden’s early years has led scholars to use circumstantial evidence to establish 1816 or 1818 as the founding date for the botanic garden in the Sydney settlement. By examining contemporary trends in colonial governance and administration, this paper offers a new interpretation of the Sydney garden’s beginnings and illustrates the political stakes of government support for botanic gardens and scientific investigation across the British empire.

Plant Mind, Plant Soul: Darwin, James, and the Problem of Plant Consciousness

Tina Gianquitto
Colorado School of Mines

Shortly before his death in 2015, Oliver Sacks wrote about the mental life of plants. Charles Darwin contemplated a related set of questions before his own death in 1882, as he investigated the movement of climbing plants. Plant life, as shown in Darwin’s books on the subject, is both active and intentional. Fascinated readers learned that climbing plants possessed volition and pursued objectives: they move “when it is of some advantage to them,” and “in manifest relation to their wants.” More dramatically, perhaps, Darwin argued that plants gather information about the world around them through tendrils and other structures that act “like the brain of lower animals...receiving impressions from the sense-organs, and directing the several movements.” The notion of volitional plants deconstructed any seemingly stable boundary between human and non-human, fauna and flora, and popular commentators looking both at the Darwinian plant world and at emerging theories of the mind and consciousness were driven to ask: “Are plants able to think?” and “Is there...a consciousness in vegetable organisms?” This paper investigates the startled reactions—from amused and bemused to downright panicked—that readers of periodical literature in the U.S. had to Darwin’s observations on the movement of plants and on the significant yet understudied role that Darwin’s plant studies played on developing theories of consciousness, especially those of William James, in the late nineteenth century.

Planted Poison and the Chemical Examiners in British India

Mitra Sharafi
University of Wisconsin-Madison

This talk examines the work of British India’s chemical examiners (1879-1947) not only in detecting criminal poisoning, but also in identifying cases of fabricated evidence in which poison was planted by colonized subjects to frame adversaries. Colonial stereotypes about ‘native mendacity’ powered the turn to forensic science during the late nineteenth and early twentieth centuries: if the courts could rely on scientific experts and test results, they could sidestep the perjury and forgery that was believed to be rife in ‘this land of lies.’ The belief that colonized subjects might try to frame their rivals by planting poison also produced a heightened awareness of the risk of wrongful convictions, at least when produced by lab work. The talk features cases of mineral poisons planted in liver and stomach samples where the form or location of the poison was wrong. It also examines debates over best practices in the sealing and preservation of forensic samples. Ever mistrustful of non-elite South Asians, British officials were convinced that lower-caste postal and railway workers would add arsenic to unaccompanied forensic samples traveling to regional toxicology labs. The talk draws upon the annual reports of the chemical examiners from the British Library and intra-departmental correspondence from the National Archives of India.

Plants as Case Study in the History of Philosophy, Sciences, and Medicine

Fabrizio Baldassarri
University of Bucharest

This panel aims at shedding light on a relevant field of the history of science: botany. The study of plants
remained generally immersed in collections of items or in the work of apothecaries, or displayed a secondary role in scientific knowledge. Although this picture has never been properly engaged, recent studies have shown the vitality of botanical interest in the history of sciences. This panel spans from the Middle Age to the Nineteenth century botany. In this panel, we would like to present a few overlooked aspects of the study of plants in their own respect, as we deal with the work with vegetation in different disciplines of knowledge. In the first talk, Marilena Panarelli discusses the case of Albert the Great’s study of plants. In the second talk, Maria Carrion analyses the interconnection between dried gardens and natural philosophy in the Renaissance period. In the third talk, Fabrizio Baldassarri presents a few cases of Seventeenth-century physicians who dealt with plants in order to explain several organs and living activities. In the fourth talk, Norbert Peeters studies Charles Darwin’s shrub-like diagram, which serves him to supplant the ladder-thinking and propose an alternative living model. In the fifth talk, Gabriel Finkelstein presents the decline of Alexander von Humboldt’s method in the study of Nineteenth-century botany as it emerges in the work of Joseph Dalton Hooker.

**Plants as Models in Early Modern Medicine: The Case of Riolan le Fils, Harvey, and Malpighi**

Fabrizio Baldassarri  
*University of Bucharest*

In the Seventeenth century medicine, botany does not restrict to the uses of simples and the fabrication of therapeutics, but also to the analogy between plants and animals. The study of plants work in the explanation of some specific living conditions, operations, and organs. In this paper, I especially focus on three different cases that reveal a common goal: Jean Riolan, William Harvey, and Marcello Malpighi. In Les Â’uvres anatomiques, Riolan repeats Galen’s claim that the foetus lives in the same way of plants at the beginning of generation, i.e., when neither arteries, veins, pulse, brain, nor the heart are formed. Riolan demonstrates his position on the ground of anatomical studies on the formation of the veins and arteries, but also works on plants in order to describe generation and details about the different stages of life. In Exercitationes de generationem animalium, Harvey deals with the seeds of plants to exemplify several issues of his study of eggs. He also stresses that the early stage of the life of foetus corresponds to the life of a plant, therefore equating plastic virtue to the formative faculty. In Dissertatio epistolica De Formatione Pulli in ovo, Malpighi stresses a similarity between animal eggs and the seeds of plants, whose study he considers a means to enter the secrets of living bodies. He especially focuses on the movement of sap and on the movement of blood, and he compares the hydraulic mechanism of filtration of specific organs to the structure of plants.

**Policing, Forensics, and the Social History of Photography: Bertillon’s Crime-Scene Photographs and their Museum Display**

Kelly Gates  
*Communications and Science Studies, UC San Diego*

Most histories of photography, including social histories, make only passing reference to forensic photography or other police uses of the medium, if any mention at all. Art historian Alan Sekula called for a more expansive social history of photography that included police archives in his now classic 1986 essay, “The Body and the Archive.” Sekula’s article is one of the first English-language examinations of 19th Century French police official Alphonse Bertillon, who is now widely credited with developing the first standardized techniques of both mug-shot and crime-scene photography. Since then, much has been written about Bertillon’s system of anthropometry, for criminal identification, with some attention to his innovations of both the mug shot and a system of mug-shot indexing. Much less has been said about Bertillon’s crime-scene photography. This paper begins to piece together the unexamined history of crime-scene photography, starting with Bertillon’s vertical-perspective photographs of murdered bodies, which have recently surfaced in a number of
Bertillon’s systems represent an earlier moment in the modernization of the forensic sciences, the technology of photography, and the institution of policing—each entangled with one another. I argue that innovations in police and forensic photography have played a central role in the modernization of both the policing and the forensic sciences, and in the development of the decisively modern medium of photography as such, and that the modernity of police and forensic photography is nowhere more apparent than when displayed in the museum exhibition.

**Popular Science Periodicals and the Public Sphere after Darwin**

Bernard Lightman
York University

The key to understanding the response of liberal intellectuals to the constraints that faced them in the post-Origin of Species era lies in an examination of the world of Victorian periodicals. Macmillan’s Magazine was one of several new monthlies that, beginning in the 1860s, altered the dynamics of the public space for debating the issue of the relationship between science and religion. These journals were founded just as the evolution issue sparked discussions about this relationship. In effect, journals like Macmillan’s Magazine sought to expand the bounds of permissibility through the creation of a new format that encouraged the toleration of unorthodox views. They provided an outlet for Darwinians who sought to establish themselves as respectable, cultural authorities while challenging the conventions of polite debate. The period after the publication of Darwin’s Origin was also characterized by the founding of new popular science journals. This paper mainly asks, how did popular science journals treat the topic of the relationship between science and religion from the 1860s to the early 1880s in light of the creation of new spaces for debate in the general periodical press? An analysis of eight of the new popular science journals founded in this period reveals the adoption of four different strategies for maintaining open debate on controversial scientific theories. In each case, these periodicals rejected or avoided the idea that science and religion were in conflict.

**Ports and Pestilence: Medical Surveillance and Sanitary Imperialism in Late Nineteenth-century North Africa**

Edna Bonhomme
Max-Planck-Institut für Wissenschaftsgeschichte

Everyone is watched, but not everyone is monitored in the same way. Contagion and the threat of contagion elicits medical surveillance in port cities through monitoring, regulating, quarantining goods and people. In the late nineteenth century, Alexandria, Tripoli, and Tunis were commercial zones where episodic plague and cholera epidemics proliferated causing commercial and mortuary crises. Independent of these outbreaks, constituents such as the International Sanitary Conference (1851) enacted policies to standardize quarantine measures at an international level, which was contested and repackaged in non-Western contexts. How these epidemics were understood and framed was part and parcel of ongoing nationalist and in Mediterranean port cities and beyond. This paper examines the ways that three North African cities—Alexandria, Tripoli, and Tunis—operated as sites of medical surveillance during the late nineteenth century. It does so by showing how indigenous and foreign merchants and medical practitioners defined and regulated goods and people. Starting from the vantage point of the port, the research shows how human and nonhuman entities, whether they were perceived to be infectious or not, were part of a process of globalizing medical surveillance. The port’s physical landscape operates as a case study for understanding how surveillance and sanitation were intimately tied to shifting notions of disease, medicine, and therapeutics in late nineteenth-century North Africa.

**Post-Colonial (bio)Prospects: Founding a Seed Bank for Kew Gardens**

Xan Chacko
University of California, Davis
The Millennium Seed Bank (MSB) at Wakehurst place in West Sussex, England is the largest repository of plant genetics resources (PGRs) in the world. Founded in 2000, the MSB functions as a hub for a global partnership program between the Royal Botanic Gardens, Kew and local partners from over 80 countries. According to their self-published institutional history, the MSB was created to take on the mantle of global biodiversity conservation at a moment of ecological crisis. I study the bio-politics of the recasting of Kew’s role as arbiter of colonial botanical knowledge to keeper of botanical futures through seed banking. While the MSB is a part of Kew’s vision to stay at the cutting edge of conservation and environmental governance, its relationship to colonial botany and political economy must also be interrogated in the light of new regulations in intellectual property rights. How do institutions deeply implicated in the colonial control over the production and dissemination of knowledge continue to stay relevant in a post-colonial era. How do they maintain their access across less-porous boundaries? With institutional documents and oral histories gathered from founding employees of the MSB, I revivify the origin story of the MSB. I investigate Kew Gardens’ ‘rebranding’ as Kew Science and the MSB to show an example of how one institution in a post-colonial era distinguishes itself from the colonial movement of botanical specimens for economic gains, but is, at the same time, an extension of a long tradition of plant exploration, accumulation, and exchange.

**Posthumous Publishing and the Culture of Co-authorship in Eighteenth-century Botany**

Bettina Dietz
Hong Kong Baptist University

This paper explores the culture of co-authorship in eighteenth-century botany, focusing on the practice of posthumous publishing and the publication trajectory of the papers and illustrations left by the French botanist Charles Plumier (1646-1704). In 1689 Plumier had travelled through Martinique and St. Domingue in order to investigate the pharmaceutical uses of the flora of the French Antilles. He had brought back a rich haul of descriptions and drawings, and he worked fast to have them published. Within ten years, three illustrated botanical works had come out. Yet they contained only a small part of what he had gathered. When he died much of this botanical material, eagerly awaited by the botanical community, was still unpublished. As the information economy of botany tried to prevent the loss of precious data, other botanists took on the task of editing Plumier’s manuscripts. Several authors were involved in a publishing process, whose aim was less to make the material available to the botanical community in an original version than to update and correct it. The resulting layering of information shaped not only the appearance of the published text, but also far-reaching forms of scientific co-authorship.

**Principles of the Ice Age: Calculating Cosmological Influence**

Alexis Rider
University of Pennsylvania

This paper explores the work of Scottish scientist James Croll (1821-1890), whose interest lay in explaining the underlying principles—not just the physical, geologic remains—of the Ice Ages. In 1875, Croll published Climate and Time in their Geologic Relations: A Theory of the Secular Changes of the Earth’s Climate, a work in which he calculated the variation in eccentricity of the Earth’s orbit over a four-million-year period. Agreeing with astronomers before him, Croll argued that the orbital variation alone could not induce an Ice Age. Crucially, however, Croll suggested that they could trigger positive feedback loops in global environmental systems, specifically ice coverage (the albedo effect) and ocean circulation, that would induce such a dramatic, planetary change. Through a deductive approach based on mathematical calculations and physical laws, Croll both posited a fluctuation in ice coverage over time (glacial and interglacial periods), and emphasized how ice is an essential part of the
Earth system as a whole. Croll’s methodology was entirely distinct from the induction and observation of his geologist contemporaries, and offers insight into the important role of physicists in conceptualizing deep time in the nineteenth century.

**Printing, Publishing, and Circulating Books across the Botanical World of Joseph Banks**

Edwin Rose
*University of Cambridge*

The only publication Joseph Banks (1743-1820) is remembered for is the Florilegium, a series of illustrations that represent the plants he and Daniel Solander (1733-1782) collected during the Endeavour voyage to the Pacific between 1768 and 1771, which remained unpublished until the 1980s. However, from the early 1780s, Banks published and oversaw the production of a large number of different works concerning the botany of the West Indies, Japan, India, China, Africa and species cultivated in Kew Gardens. My discussion will be in two parts, concentrating on Banks’s books Reliquiæ Houstounianæ (1781), on the plants of the West Indies, and Icones Selectæ Plantarum (1791), on the plants of Japan. The first will examine the processes employed to produce a work of natural history in the late eighteenth century, which involved the conversion of a three dimensional natural history collection into a printed work. Banks’s publications were privately printed, using the highest quality materials and most skilled craftsmen available in London. Secondly, I examine the distribution of these works. Banks had a small number of copies printed that he circulated to a specific group within the Republic of Letters and to those undertaking fieldwork in Asia and the West Indies, avoiding the emergent commercial publishing industry. An analysis of these publications from their inception to distribution gives a new understanding of the methods and incentives for producing a work of natural history in late eighteenth-century Britain.

**Properties, Predictions, and Mathematical Theories in Newton’s Optical Investigations**

Alan Shapiro
*University of Minnesota*

It has long been debated whether Newton’s theory of color and, more generally, his optical investigations are mathematical, but Newton himself always insisted that his theory of color and that of the colors of thin plates are mathematical theories. He based his claim on his ability when utilizing these theories to predict and calculate all the phenomena of interest. Newton favored mathematical theories in order to avoid invoking speculative physical causes. He repeatedly claimed that his aim was to establish properties of light and not hypothetical physical causes. Newton desired causal theories but would not adopt those causes that he judged to be hypothetical, such as forces or vibrating aethers. I will argue that he believed that his theory of color did not provide a physical cause for the appearance of spectral colors after refraction, but rather an explanation, namely, that the rays are separated by their property of unequal refrangibility. I will describe the nature of these mathematical theories and how they were more a program than full-fledged mathematical physical theories. In contrast to these theories, I will briefly present his theory of colored bodies, which was his only optical theory that was explicitly cast in causal form. Here too calculation and prediction played an important role for Newton.

**Proving Accelerated Wasteland: The Infrastructure of Cape Canaveral Missile Test Annex**

Jeffrey Nesbit
*Harvard University*

Early Cold War anxiety over nuclear conflict generated an unusually rapid speed of proving grounds, a site designated for military tests in technology, along the Florida coastline. Cape Canaveral Missile Test Annex—a region historically occupied by the native Ais tribe and their “crude and flimsy” structures—was built over a wasteland of
unstable grounds. This remote wasteland was intentionally selected by the U.S. military to construct its missile operations; a suitable decision for military security and economic stability with close proximity to the equator for launching rockets into orbit. As development of one missile technology emerged, so too did its associated infrastructure in the remote Florida wetlands. With the fear of nuclear warfare conflict on the rise during the mid-late 1950s, the launch pad infrastructures had increasingly become the image of projecting missile muscle in hopes to deter nuclear war. Beginning with a brief account of early Cape Canaveral, the seemingly rationalized techno-spatial landscapes of scientific struggle, Launch Complex 18 constructed in 1955, illustrate a culture of intense progress followed by abrupt decline and varied commemoration. This paper suggests the configuration of military infrastructure in the once remote wasteland of Florida’s coast was not a process of technologically rationalized proving ground, but instead a process of operational flexibility and ultimately a means for territorial projection and political control.

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**Pursuing the Next Green Revolution in Korea: “Scientific” Promotion and Demise of Barley in South Korea**

Tae-Ho Kim  
*Chonbuk National University*

Traditionally, barley was the second most important crop in the Korean Peninsula. When Japanese colonial authority in the early 20th century transplanted Japanese agricultural science and related discourses to Korea, it became the main agenda to increase production and consumption of barley, to spread the growing demand for rice over the Japanese Empire. While plant breeding scientists developed higher-yielding new varieties, nutritional scientists propagated a variety of discourses that emphasized nutritional value of barley, and the colonial government mandated (partial or whole) replacement of rice with barley in everyday diet. This triangle of agro-science, nutritional science, and coercive administration even survived dissolution of the Japanese Empire in 1945 and remained the backbone of South Korean food policy by the late 1970s. When South Korean government declared the accomplishment of the Green Revolution of rice in 1977, self-sufficiency of barley was officially acknowledged as the next goal. It soon turned out, however, that this “second phase” of the Green Revolution was an unreachable goal. Despite considerable innovations from the agricultural scientists, which could contribute to actual increase in barley production, people’s memory of coercive consumption led them to avoid barley. Meanwhile, influx of affordable wheat flour from the US also provided alternative options to Korean consumers, which had never been available in the previous Japanese Empire network that emphasized self-sufficiency. By showing the demise of barley cultivation in South Korea, this paper illustrates how the interaction among science, society, and state is embedded in the artifact of barley.

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**Que nuestro Pueblo Viva como Gente: Mexican Citizens, Consumers, and Bodies under Cardenismo**

Steve Server  
*University of Chicago*

The start of the Cárdenas administration in 1934 is often seen as the moment when the promises of the Revolution were finally made real for the wide array of Mexicans who had fought in the decade-long conflict of the 1910s. Mexican citizens were able to farm land communally, had access to state-regulated education, had protected labor rights, had access to public health resources. But the progress of the 1930s brought a critical question to the fore: was Mexican economic and political life to be “top-down” or “bottom-up”? Was the health of the nation to be found in Mexico City, or the nation’s rural localities? In this paper, I explore the relationship between national economic and political “health” and physical health during the period. By reference to medical journals, medical student theses, and health department memos, I show that physical health was not merely a practical concern for the state, the hope
being to create scientifically literate, productive, “modern” Mexicans. Physical health also became a vital rhetorical space for Mexicans to negotiate the terms of Mexican progress, in domains such as labor organization, school curricula, ethnic and indigenous rights, and political representation. It was the language of health that served as the lingua franca for the ongoing negotiations which would determine the ultimate character of the Mexican state--and of Mexican development.

Queer Science

Beans Velocci
Yale University

The history of science is full of queer potential. Reassessing what's considered natural, interrogating supposedly self-evident ontologies, challenging a split between knowledge and power--these are tasks and commitments often shared by history of science and queer scholars alike. Yet, specifically queer histories of science remain few and far between, and although scholars of gender and sexuality, thanks to Foucault, often look to sexology as a key producer of the sexual subject, few have engaged with the rich theoretical and methodological groundwork laid by scholars in history of science and STS. This panel highlights the possibilities of a fruitful union of these two frameworks in four papers that bring a queer analytic to bear on a variety of topics in nineteenth- and twentieth-century history of science, including animal studies, computing, mutation, and ethnology. In imagining queer science broadly--queer actors, queer methods, queer (and anti-queer) uses of science--this panel frames queerness as central to the enterprise of knowledge production both now and in the past, applicable and indeed necessary to consider across a broad range of times, places, and topics, rather than a marginal consideration important only to those working on sexuality. Together, the scholars on this panel will imagine a way forward that bridges and builds on histories of science and queer studies, showing, too, the ways in which the two have been united all along.

Queering Computing History: A Pre-History of Trans Algorithmic Bias, 1950-1975

Marie Hicks
National Humanities Center

In the heyday of the British Welfare State, in the decades immediately following World War II, people's worth was assigned and quantified along heteronormative, gendered lines. Electronic computers implemented the policies that created the Welfare State, leading to some of the first examples of algorithmic bias along the lines of gender identity. This paper looks at how computers exacerbated existing discrimination and how transgender British citizens in particular fought back--forming a class of users that resisted how state technologies positioned their lives outside the operating parameters of newly-developing digital systems.

Quotient of Malleability: Breeding and the Renaissance Animal

Mackenzie Cooley
Cornell University

As a self-described magus, Giovanni Battista della Porta (1535–1615) was convinced of his power to manipulate nature. Given proper conditions, the Neapolitan scholar believed that dogs could be made to degenerate from four-footed creatures to two-footed ones. Porta wrote that by amputating dogs across successive generations and compelling the amputees to reproduce, one could compel “nature to produce bipedal canines.” Surgery combined with controlled breeding yielded an entirely new so-called race (razza) of animals in a few short years, he alleged.

While Porta's bipedal canine experiment would not have been as effective as he reported, highly bureaucratized animal breeding projects across Europe and its territories around the world generated vast numbers of animals. Theories of inheritance reciprocally influenced breeding practices that took place on stud farms and courts to fashion horses, dogs, and other creatures. Using genealogical trees and multi-generational charts, experts selected
livestock and companion animals and paired them in carefully orchestrated unions with the hopes of shaping their offspring as much as possible through the combined effects of imagination, environment, and parentage.

By combining archival and bio-archaeological evidence, this paper evaluates both how effective Renaissance husbandmen believed themselves to be when it came to influencing bodies through breeding, and how effective their methods actually were in producing new variations of animals. This paper uses a “quotient of malleability” to compare case studies from breeding experiments in sixteenth-century Italy, Spain, and New Spain, reading beyond the experts’ self-validating rhetoric—like that employed by Porta.

Racial Prejudice and the Lost Legacy of Jagadis Chandra Bose, India’s First Plant Physiologist

Jagadis Chandra Bose (1858-1937), India’s first plant physiologist, deviated boldly from mainstream botany by claiming that plants possess “nerves” and “pulsating cells” that function much like the nerve and heart cells of animals. In support of these ideas he recorded “plant autographs,” i.e., continuous, high-resolution measurements of plant functions by means of assorted ingenious instruments of his own design. Although Bose was the most internationally celebrated plant biologist of his era, Bose’s detractors in the West, by accusing him of virtually every academic malfeasance, including technical incompetence, mysticism, insanity and fraud, effectively expunged Bose from Western histories of plant biology. Nearly all of Bose’s scientific claims have since been confirmed but without attribution. It is proposed that that attempts to understand Bose’s reception by the West wholly in terms of scientific dialectics ignore the fact that the progress of science cannot be divorced entirely from the cultural and social lives of its practitioners. Given the times in which Bose lived, one obvious hypothesis to explain the West’s rejection of Bose’s scientific views is that Western opinions of Bose may have been tainted by the racism rampant in the West at that time. Archival research will be presented that supports this hypothesis.

Radiance at the Limit of the Material World: Light as a Property of Physical Bodies in Thirteenth-century Paris

Therese Cory
University of Notre Dame

The theories of light that were in circulation in the European universities of the thirteenth century are currently not well understood, partly because of the tremendous diversity among these theories and the wide range of sources that were drawn upon (for instance, Albert the Great, writing in 1242, identifies eleven different sources and obliquely references many more). Indeed, in the mid-thirteenth century in Europe, theories of the natural world were in a state of accelerated turbulence and change, as European thinkers were exposed to a torrent of new debates and new theories about the physical realm, arriving from Greco-Arabic “natural philosophy.” In developing new visions of the physical world at this time, an important puzzle arose for thirteenth-century thinkers, concerning where light fits into the picture. Is light situated within the world of matter and motion (i.e., having “natural being”), or is it something immaterial? In this paper, building on previous work on medieval Arabic theories of light, I examine a group of three theories from Paris in the 1240s-50s that came down firmly on the physicality of light: the theories of Albert the Great, the early Thomas Aquinas, and Bonaventure. For all three, light is a property of bodies. Nonetheless, they have trouble explaining why light seems unlike other physical states (e.g., existing in different ways in solid bodies and translucent bodies). I will discuss how they resolved these difficulties, and what their resolution reveals about how they integrated new scientific knowledge.

Radiation, Indigenous Peoples, and Expertise in the Far North
This panel will explore three episodes of potential radiation exposure among indigenous group in the far north during the twentieth century. We aim to better understand Cold War anxieties about nuclear radiation and the relationship between outside experts and indigenous peoples living in contaminated regions. There are varied political dimensions to our stories as well, including state secrecy during the atomic and space ages, indigenous activism and claims for sovereignty and recompense, the temporal aspects of settler colonialism, and scientists’ uneasy campaigns to marshal native peoples as witnesses who could bolster their own claims of expertise. Another key theme uniting the papers is the migrations of radioactive pollution from the molecular to the cosmic level and across international, regional, and imaginary borders. Our three cases involve Arctic territories of Alaska and Canada and an area in subarctic Siberia. Lisa Ruth Rand will examine an episode of nuclear-powered space junk falling over the Canadian north and what it reveals about a radioactive continuum that extended from the underground to outer space. Tess Lanzarotta’s paper highlights the contestations among local politicians, outside scientists, and Alaskan natives about how to understand and cope with radioactive contamination in the Arctic at the end of the Cold War. In his presentation, Andy Bruno will discuss the efforts of amateur expeditionary scientists to detect evidence of radioactivity at the site of the mysterious Tunguska explosion in Siberia and how they solicited Evenki observers in their research.

Alaskan political officials, federal government scientists and biomedical ethicists, and Alaska Native leaders and activists found themselves involved in a series of contestations over how and if these concerns could be addressed. Alaska Native communities would be left asking: Who gets to decide when an issue is resolved? How are different versions of the past made legitimate? And, what kinds of imagined futures inform scientific policy decisions? This paper, then, centers scientific temporalities of the Cold War as both a tool of American settler colonialism, and as a potential avenue for Alaska Native self-determination.

**Rand McNally’s Geophysical Globe: How the Earth was Depicted during the Early Space Age**

*Simon Whitehouse
Florida State University*

This year marks the 50th anniversary of Apollo 8—the American manned space mission that for the first time sent to Earth true photographic images of the planet. Scholars have argued that the images had a direct impact on the American environmental movement and helped to shape political culture in later decades. This paper argues that a six-foot geo-physical globe model located in major institutional spaces across...
North America had already showed the planet’s true physical features due to the collaboration of popular magazine artists and leading scientists. Little scholarship has examined how this globe model contributed to science education and our visual understanding of Earth. This study rests on a broad foundation of primary source research. Through photographic representation in major American magazine publications, archival research from the Rand McNally and Company records, oral history interviews with globe manufacturers, geographers, museum professionals, and cartographers, this paper shows how Rand McNally brought together the work of visual artists and scientists to add to our knowledge about Earth. This presentation asks the following questions: How did Rand McNally’s geophysical knowledge reach the American public through a giant globe? How did post-war advances in biology, astronomy, oceanography, geography, geology, and cartography help our understanding of what the Earth looked like before space exploration? How did the globe’s prominence decline as technology advanced in other ways?

**Reclaiming Be-hi ka-li, A Traditional Indigenous Food and Medicine Plant: Decolonizing Western Botany**

Frederica Bowcutt  
*Evergreen State College*

Be-hi ka-li (*Umbellularia californica*) is a hardwood tree native to California and southwestern Oregon with the potential to be a more widely valued source of a chocolate-like superfood in the future. Its nut is a nutrient-dense food and the leaves have many medicinal properties. Known by numerous different English names including California bay, Oregon myrtle, and pepperwood, the avocado relative is garnering the attention of an increasing number of wild food foragers and trend setting chefs in the restaurant industry. Simultaneously, some people hope to commercialize production of the nuts to foster economic development and food sovereignty in Indian Country. Although the evergreen tree is adapted to the droughty west coast of North America, it is known to be an intermittent fruit producer and to be vulnerable to a variety of diseases and pests, as well as climate change. These challenges need to be addressed if Oregon myrtle is to become a profitable commodity. However, negative environmental and social impacts could potentially result from commercialization as well. To better understand the risks and identify strategies for guarding against such unintended consequences, this case study of Oregon myrtle considers knowledge construction and use in historical context. Particular attention is paid to the legacy of colonial botany, patent law, indigenous proprietary knowledge rights and native food sovereignty. Based on the historical record, without changes to the practice of capitalism and its relationship with science, commercializing Oregon myrtle will unlikely benefit Indigenous people or sufficiently mitigate the externalized environmental and social costs of global capitalism. However, that doesn’t preclude botanists from examining and challenging the colonial legacy of their profession and seeking to use their knowledge to collaborate in contemporary food sovereignty initiatives and alternative forms of emancipatory economic development.

**Reductionism and Holism in Early Twentieth Century Neurophysiology: A Comparison of Sherrington’s and Goldstein’s Views on Integration and the Mind-Body Relation**

Mahi Hardalupas  
*University of Pittsburgh*

In 1906, English neurophysiologist Sir Charles Sherrington published *The Integrative Action of the Nervous System* describing how animal movement was built up from the interaction of reflex arcs, which were unit mechanisms of the nervous system. This is widely regarded as a seminal work heralding modern neuroscience and its current reductionist approach. Geroulanos and Meyers (2016) interpret Sherrington as a reductionist whose views were in direct conflict with those of holistic psychologists such as Kurt Goldstein. Goldstein was a German neurologist and contemporary of Sherrington’s who, in his book *The
Organism' (1934) developed a holistic approach that challenged the view that investigating isolated parts could inform you about the whole organism. In this paper, I examine Goldstein’s criticism of Sherrington’s reflex-theory in 'The Organism' to suggest that the contrast between their views is more nuanced. First, through close analysis of 'The Integrative Action', I question the interpretation of Sherrington as a reductionist. Then, in light of this, I show that there are in fact similarities between Sherrington and Goldstein’s views. The main disagreement between them was ultimately a methodological one. I argue that this can be better understood with reference to their different social contexts and their views on the relation between mind and body. To this end, I outline the differences between the German and British neurophysiological traditions in the nineteenth century. I conclude that the differences between Sherrington and Goldstein reflect the diverging attitudes towards the mind-body relation in Germany and Britain in this period.

Regino García and the Visible Collectors of Colonial Botany in the Philippines

Kathleen Cruz Gutierrez
University of California, Berkeley

This paper investigates the training and work of Regino García y Basa, a Filipino painter and botanist who shaped the science and visuality of Philippine flora in the late nineteenth and early twentieth century. Most well known as the lead illustrator of Manuel Blanco’s Flora de Filipinas (1877-1883), García also appears in Spanish and U.S. colonial records for his astute botanical work. His career stretched from the Jardín Botánico de Manila in 1866 to the beginnings of U.S. colonial rule in the Philippines. Given his scientific life, García provided institutional memory for U.S. colonists such that Elmer Merrill, the most widely published American botanist of Philippine flora, recognized him as “one of the very few natives of the islands who has accomplished any work of a botanical nature.” While García is one of the few better-documented Filipinos in colonial botany records, studying his work opens avenues for understanding ruptures and continuities in Philippine botany during the Spanish-to-U.S. colonial transition. By mapping García’s career, this paper also reveals a more nuanced understanding of a stratified hierarchy—shaped by race, class, and training—that existed among local men and their scientific contributions to Philippine botany. The essay contends that this more nuanced understanding provides opportunities for scholars not only to excavate and document the legacies of local actors within colonial science, but also, and more critically, to problematize their (in)visibility as collectors of flora and producers of knowledge.

Regulating Chemical Risks and International Trade at the Organization for Economic Cooperation and Development

Colleen Lanier-Christensen
Harvard University

In the 1970s, governments worldwide vastly expanded their pre-market review of chemical data, and with it the need for toxicological testing. Previously, such review was only required for products intended to have biological effects, such as drugs and pesticides. Legislators and regulators weighed competing priorities: assessing health and environmental risks; conserving limited testing resources; and harmonizing different national testing requirements so as not to create trade barriers that would fracture international markets. Seeking to balance these priorities, in 1981 the 24 industrialized nations of the Organization for Economic Cooperation and Development (OECD) adopted common chemical testing standards. Under the framework of “Mutual Acceptance of Data,” member governments agreed to accept all data from toxicological tests that adhered to a collectively agreed upon set of standardized test methods and strict requirements for “good laboratory practice.” All data that adhered to these standards, regardless of country of origin, would be accepted as a basis for decisions. Data that did not adhere to this framework would not be accepted; this proved to exclude most academic toxicology studies. This paper will examine how
standards helped to create an international infrastructure of chemical regulation: the rules made chemical data legible to and portable among bureaucratic governments, enabling governance by distant authorities while also liberalizing international trade. OECD nations regulated laboratory practice to control market behavior, and this constrained the type of testing done and knowledge produced.

**Remaking Mice for Reproducibility**

Nicole Nelson  
*University of Wisconsin-Madison*

In investigating how particular organisms became standard objects of scientific study, historians have tended to focus on the role of particular research communities (Kohler 1994) or institutions (Rader 2004) in these processes. More difficult to conceptualize are the forces shaping scientific organisms that extend beyond these units of analysis. This paper will examine the “reproducibility crisis”—a recent phenomenon where scientists across fields have found findings to be difficult to replicate on subsequent analysis—and how this crisis intersects with the evolving life courses of experimental organisms. Specifically, the paper will focus on attempts to standardize mouse housing and testing conditions, such as recommendations to harmonize variables such as the temperature in mouse housing rooms. Over the last ten years, numerous institutions have begun advocating for increased standardization in animal research in the name of enhanced reproducibility, including major funders (eg. the National Institutes of Health), major journals (eg. Science magazine), and professional organizations (eg. the National Centre for the Replacement, Refinement and Reduction of Animals in Research). The impact of these initiatives extends far beyond the boundaries of any particular research community, however defined. This paper will argue that analysis at the level of the institution or the community fails to adequately characterize the reproducibility crisis, which derives its ability to shape scientific organism and practices from the alignment of multiple institutions, much as a magnet derives its strength from aligning the polarity of individual atoms.

**Remaking the Body: Hermaphrodites and the Science of Surgery in the Late Middle Ages**

Leah DeVun  
*Rutgers University, New Brunswick*

This paper focuses on “hermaphrodites” -- that is, individuals who were considered neither simply male nor female -- and the emerging profession of surgery in thirteenth- and fourteenth-century Europe. This era constituted a critical period for the profession of surgery and, as I argue, for long-lived ideas about anatomy’s role in establishing sex. During this period, surgeons made novel claims about their authority to regulate sexual difference by surgically “correcting” the errant anatomies of hermaphrodites. Surgeons’ theories about sex drew upon cultural ideas about gender and anatomy, as well as upon particular notions of what made something “natural.” As this paper shows, technologies of measurement were also finding new prominence within Italian communes just as certain surgeons—who hailed from the same region—were embracing dimensional standards with respect to the human body. I argue that this focus on standardization, which regulated the size and shape of all kinds of materials, mirrored efforts by surgeons to police the body’s proportions and to return it to a “natural” form.

**Representing Science and Space with the Digital Humanities**

Molly Nebiolo  
*Northeastern University*

My work encompasses various digital humanities projects on the representation of urban space in early Boston. I will discuss the tools I used for this project, and the promising applications of digital humanities tools to better understand environmental history and the history of science as a whole.
Reproducing Human Capital: The New Microeconomics of Fertility and the Biopolitics of Birth in the 1970s

Jonny Bunning
Yale University

Economics and the life sciences have long shared an interest in population, but in the early 1970s the status of that object changed. Whereas Malthus and his followers treated population growth as an exogenous, iron force pressing in on economics, and whereas neoclassical economists simply bracketed out the problem of human embodiment, economists now used the revamped concept of human capital to reframe population changes as fully endogenous to economic analysis. Reproduction, argued men like Gary Becker, T. Paul Schultz, and H. Gregg Lewis, was a form of capital investment based on the rational expectations of sovereign consumers: having children was like buying a fridge.

My paper explores this microeconomic approach to human life by detailing the rise of modern theories of ‘human capital’ in the late 1950s and their application, in the 1960s, to sex and other areas previously beyond the scope of economic analysis. Reproduction, argued men like Gary Becker, T. Paul Schultz, and H. Gregg Lewis, was a form of capital investment based on the rational expectations of sovereign consumers: having children was like buying a fridge.

Reproductive Health in the 19th and 20th Centuries

Miriam Rich
Harvard University

This session examines reproductive health as a historical site of meaning-making, cultural anxieties, and contested medical and scientific authority. In the nineteenth and twentieth centuries, reproduction gained new salience as an object of medical oversight and intervention. This attention frequently centered concerns over “defective” reproduction and infant mortality. Such concerns were embedded within complex discourses of race, gender, nationalism, and medical authority. These presentations situate the aspirational management of reproductive health within specific social, political, and ideological contexts. First, Shannon Withycombe contextualizes the emergence of prenatal healthcare within early twentieth-century anxieties over immigration, race, and nationalism, showing how U.S. physicians articulated the necessity of prenatal care in terms of racial and national preservation. Next, Miriam Rich examines biomedical concepts of “monstrous” reproduction in the nineteenth-century U.S., exploring how physicians and scientists linked anomalous embryological development to claims about racial hierarchy and degeneration. Wangui Muigai then considers African American ideas and concerns about pregnancy and childbearing in the early twentieth century, situating these concerns within broader debates about racial fitness, reproduction, and maternal and infant health. Finally, Emily Harrison explores the twentieth-century use of infant mortality rates as a global metric of social health, analyzing shifting meanings and approaches in Ecuador, India, and the U.S. in the context of changing notions of medical authority, expertise, and communal health. By centering the cultural and political meanings of reproductive health, this panel builds on scholarship charting new interrelations in the histories of science, medicine, gender, and race.

Research Narratives and Conceptual Change in Developmental Genetics: Mosaics and Gene Action, 1954-1978

Robert Meunier
The paper will revisit the history of conceptual change regarding the role of genes in development, by exploring the methodology of analyzing narrative practices in research publications. Historians of biology have analyzed the role of metaphors: “field”, “information”, “program” and other concepts have been followed through merging and diverging discourses on development. Others, who emphasized the role of material practices, have shown how conceptual developments in biology are driven by the differential reproduction of experimental systems in which new entities emerge. Historians routinely use publications reporting experimental results and their interpretation as sources. To trace the historical shifts in question, I will address such texts more explicitly as sites of mediation between experimental practices and conceptual interpretation. For this purpose, it is useful to conceive of such texts as narratives, to highlight their constructed character and their ordering functions. The research narratives of geneticists selected experimental operations and observations and transferred them into the discursive realm, thus linking emerging concepts to epistemic objects. Furthermore, they often linked these experimentally specified concepts to conceptual structures imported from embryology in the interpretation of results. The latter thus function as narrative resources. Finally, their research narratives were reproduced differentially when geneticists reproduced and varied experimental systems. This perspective offers a fresh view on the history of developmental genetics. A series of research narratives that emerged in the context of the differential reproduction of experiments pursued between the 1950s and 1970s, which involved genetic mosaics and implicated genes in developmental processes will be analyzed.


Huibin Wang

From 1949 to 1958, Chinese scientific associations, including the All-China Federation of Natural Science Societies and the All-China Association for Science Popularization, acted as one of diplomatic canal to unite potential partners and fight opponents among the isolation around the world. There were three modes of transnational activities to resist the isolation. The first was academic communication involved with diplomatic purposes, including guiding scientists to follow Soviet scientific career and holding academic conferences of the World Federation of Scientific Workers. At the same time, these associations would intervene in international affairs related with science. For example, to facilitate Hsueh-shen Tsien’s return, the All-China Federation of Natural Science Societies sent a crucial letter to the secretary general of the United Nations. Finally, when the regime was offended, these professional associations would represent Chinese scientists to deliver condemnations.

Rethinking Islamic Medicine during the Bengal Famine, 1943-1945

Andrew Amstutz
Univ. of Wisconsin, Madison

This paper explores how Muslim medical healers in South Asia creatively positioned Islamic healing as a system of political critique and social renewal during the medical and political crises of World War II. Islamic humoral healing is a system of traditional medicine in South Asia that melds the ancient Greek concept of the four humors with Islamic notions of wellness. Draconian British food allocation policies and crop failures during World War II caused a famine in which three million people in Bengal died. In response, Muslim healers in Bengal (in eastern British India) made the case for Islamic humoral medicine as a tool to regulate public health that could both heal individual bodies and rebalance Bengal’s body politic during the social dislocations and medical crises of the famine. Specifically, this paper investigates the diaries and radio addresses of Habibur
Rahman, a prominent Muslim healer in eastern Bengal. As Bengal’s economic fabric was strained by the famine and the global war from 1943 to 1945, Habibur Rahman drew on the theory of the four humors in Islamic medicine to propose a social vision in which Bengal was balanced between different communities and healed by scientific food preparation. Rahman challenged British colonial assumptions about the decline of Islamic sciences in the modern era in his radio addresses and diaries. Instead, Rahman and his fellow Muslim healers contested this story of Muslim scientific decline by celebrating a ‘Golden Age’ of Islamic healing located in the Indian subcontinent during the twentieth century.

Rethinking the Medical Origins of Aesthetics: Involuntary Motion, Regimen, and the Experience of Beauty, 1700-1750

Alexander Wragge-Morley
University College London

It used to be widely accepted that the eighteenth-century emergence of the 'aesthetic' as a category of experience depended on an explicit denial of the pleasures, pains, and functions of the body. In recent years, however, scholars such as Aris Sarafianos have become increasingly interested in how medicine and theories of matter shaped the development of philosophical aesthetics, for instance highlighting Edmund Burke’s close engagement with debates about the sensibility of the body in framing his account of the sublime. In this paper, I go one step further, arguing that changing ideas about the body’s involuntary functions - along with their pathologies and therapies - had a crucial role in the development of aesthetics and art theory in Britain during the first half of the 18th century. Drawing on a wide range of sources - including hitherto overlooked manuscripts - concerning the imperceptible motions of both plant and animal bodies, the paper shows how debates about the effects of air pressure, food, and exercise on the body’s involuntary responses to the world outside it shaped some of the most important works of art theory. I thus offer a radical reinterpretation of crucial works of art theory, from Jonathan Richardson’s discourses on connoisseurship to Hogarth’s Analysis of Beauty, for the first time demonstrating how they responded to philosophical and medical attempts to describe and control the body’s involuntary functions, from John Arbuthnot’s An essay concerning the effects of air on human bodies to George Cheyne’s famous therapies for the so-called 'English Malady'.

Rethinking the Nature of Technology and Medicine: Global Spaces of Science in China and the World

James Lin
University of Washington

Beginning in the 19th century, Chinese agricultural, sericultural, and medical experts worked to adapt scientific knowledge and technology to local and indigenous contexts throughout Asia and the world. Using tropes of circulation, transplantation, cosmopolitanism, and networks, each of the papers of this panel explores how science was transformed as it moved across China and its environs. Peter Lavelle (Temple University) examines how sericulture technologies transplanted by Chinese experts into Chinese Central Asia embodied the claims of Chinese science about the natural world and its colonial subjects. Jongsik Christian Yi (Harvard University) discusses how the literal and metaphorical grafting of imported varieties of honey nectar trees onto local roostocks reveals the global nature of Longquanyi peach. Wayne Soon (Vassar College) shows how the Overseas Chinese and American aid organizations were instrumental in shaping medical sciences in early Chinese Communism, challenging the existing narratives of nativism and independence stressed by the Chinese Communists during the Second World War. James Lin (University of Washington) explores the centrality of the Global South in agricultural science networks in 1970s Taiwan, where Taiwanese experts leveraged its success in Green Revolution sciences for the purposes of greater political integration and international status. Together, these papers explore how a diverse set of international actors shaped East Asian sciences and their political,
environmental, and cultural dynamics within a global setting.

**Reweighing Antiquity: Material Practices of Precision between Science and Humanities**

Cesare Pastorino  
*Technische Universität Berlin*

This session explores quantification, measurement, accuracy, and precision at the intersection of scientific and humanistic disciplines. Past historiography has tended to associate this cluster of notions with the natural sciences. We suggest that, historically, several humanistic disciplines shared comparable quantitative aims and practices. The sciences of antiquity concerned with the material culture of the past are a particularly important case in point. Our papers will demonstrate the existence of quantitative and experimental methodologies in the two intertwined disciplines of historical metrology and numismatics. We will consider scholarship in the German-speaking countries at the beginning of the antiquarian tradition and then focus on its afterlife in the early nineteenth century. Already in the early modern period, authors of treatises “de mensuris et ponderibus” like Georg Agricola (1494-1555) and Johannes Kepler (1571-1630) routinely weighed substances and materials as an aid to the study of ancient weights and measures (Pastorino). In the eighteenth century, experimentation on material heritage gained momentum with Johann Beckmann (1739-1811), who used the “knowledge of the handicrafts” to study ancient standards of coinage (Szalay). The reception of the literature “de mensuris et ponderibus” maintained telling proximity to the treasury and questions of political economy. This will be shown for August Boeckh (1785-1867) and his seminal synthesis of all weights and measures of antiquity (Echterhölter). Boeckh transformed the antiquarian tradition but stayed faithful to the empirical rigor of the humanists. This is most evident in the operation of “comparing,” as practiced by authors subscribing to Boeckh’s research program of “comparative metrology” (Krajewski).

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**Ricardo Flores Magón, a Mexican Anarchist and Revolutionist: From Biology to Society in Periodical Press**

Juan Manuel Rodríguez-Caso  
*National Autonomous University of Mexico*

The history of biology in Mexico has focused largely on showing the impact that theories like Charles Darwin’s had during the late 19th and early 20th centuries. Recently, there has been an attempt to broaden the scope of this research by highlighting the impact of other visions such as those like Herbert Spencer’s - fundamental in Mexican education and politics - and Francis Galton’s - of importance in the institutionalization of eugenics in Mexico. However, an issue that has not been addressed is that of anarchism, which has taken up biological/evolutionary proposals (from authors such as Herbert Spencer himself, Piotr Kropotkin, among others) to found a basis for a revolutionary discourse that sought an authentic change in Mexican society. Another example, the French geographer Élisée Reclus, who maintained that "Science did not establish any difference between the words of evolution and revolution", both of which reflected, according to Reclus, in a continuous way, the infinite movement of transformation of the universe, of nature, of life, of species, of society, an interpretation shared by other authors, which Flores Magón brought together in the so-called Sociological Library of Regeneration. We want to focus this paper on the discourses that appeared in the anarchist newspaper Regeneración (Regeneration), which was edited by the Mexican revolutionary Ricardo Flores Magón. Through various examples, we want to show the influence of the biological/evolutionary theories that served Flores Magón to articulate a revolutionary discourse that distinguished itself from others by seeking authentic social change, based on biological change.

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**Roles of Education in the History of Science**

Sarah J Reynolds
Throughout history, there have been strong connections between science and education, with the history of science very often being a history of students, teachers, instructional sites, and educational activities. Education - both formal and informal - plays an important role in the formation of scientists' foundational knowledge and community practices, as well as serving as an important context for many scientists' careers. Contemporary educational research demonstrates that educational practices can have substantial and long-lasting impacts on students' understanding of science. Despite such significance, education's diversity in forms and impacts can be difficult to fully recognize and incorporate into our histories of science. In this flashtalk, I will introduce the multi-dimensional approach to thinking about education's role in science, and critically analyzing its impact, that I have developed and used in my dissertation work on 19th-century American science education.

Science (Studies) Fiction: Michael Crichton and the Postwar History of Reality

Joanna Radin
Yale University

Feminist and decolonial historians of science have learned to ask “who gets to be a reliable knower of technical knowledge?” In this paper, I ask who gets to be a reliable knower and practitioner of science studies. I focus on the fiction of Michael Crichton who came of age as undergraduate and medical student at Harvard in the late 1960s. Today, his name is a metonym for the literary genre known as the “techno-thriller.” What is less often recognized is his early career as a medical reformer and sustained engagement with the history and sociology of science. In our present age of “alternative facts,” there is much to be gained by recognizing Crichton himself as an apt pupil of our own discipline—especially for those of us who do not identify with the vision of science his work popularizes. I take Crichton’s published fiction and nonfiction as my archive, including also the way his work has been engaged by historians of science. In doing so, I am able to bring new considerations to the history of the “Science Wars,” and its ramifying legacies in the present. Crichton, I conclude, demonstrates how science studies’ critique of facticity has been ironically repurposed to defend an ideal of science without politics.

Science and the Native Tongue: Agricultural Scientists in the Laboratory and Beyond in Colonial Bengal

Pankoj Sarkar
Tata Institute of Social Sciences, Mumbai, India

The existing literature coming from Science and Technology Studies (STS) on colonial India so far has paid insufficient attention to the agriculture sciences. Moreover, the existing studies on colonial India look as scientists not as practitioners of science, but rather as intellectuals and actors engaged in the task of building a modern nation. This article attempts to bridge this gap in the literature by analyzing the native agricultural scientists as science practitioners, as well as their evolving ideas of modern agriculture. It also tries to understand whether the “native scientists” and the colonial British scientists had varying ideas of modern agriculture.

With a handful of exceptions, the historiography from STS perspective of colonial India has primarily relied on English language colonial archival sources. This analysis makes use of both vernacular (Bengali would be used as one of the vernacular archival sources in this research) and English archival sources. This brings on board a broader and divergent perspective in understanding agricultural sciences from the point of view of both the colonizers and the colonized.

Preliminary analysis found that though the “native” Indian agricultural scientists were working under the British government in India, their ideas of modern agriculture for Indian soil varied from those of their British counterparts on many occasions. This is evident when we look at their engagement with various stakeholders both inside their workspace and
outside such as their peers, within their laboratories, counterparts, colleagues, cultivators, and literati.

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**Science Stories: The Life and Labor of Local Scientists in the Making of Modern Southeast Asia**

Anthony Medrano  
Harvard University

The century from 1840 to 1940 was a watershed moment in the global history of science, marked by infrastructural, technological, and political changes that transformed the culture and circulation of knowledge production. It was a time when forensic expertise turned dead bodies into juridical subjects, old gardens evolved into new laboratories, nature’s insects became agriculture’s pests, and expert fields shaped national imaginations. Most importantly, however, it was a period that opened up spaces and trajectories for local scientists to forge political power through scientific practice. In Southeast Asia, as in other regions of the global South, scholars have traditionally placed colonial administrations and coercive connections at the vanguard of these developments. This panel draws on multilingual sources, archival research, and ethnographic fieldwork to chart a set of science stories that locates Southeast Asian experts at the heart of this historical moment. In particular, the panel uses the life and labor of local scientists to recast the history of science in Southeast Asia in ways that surface new interactions and infrastructures while also complicating old narratives and geographies. From Manila to Bangkok and from fisheries to forensics, it documents the sharp and subtle forms in which local scientists and their networks figured in the making of modern Southeast Asia. In sum, the panel foregrounds experts at the intersection of cosmopolitan and vernacular worlds whose labors were not only central to the workings of global science, but also, and most crucially, vital to matters of political and economic life.

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**Science, Illustrated: The Circulation and Translation of Images in China’s Popular Science Pictorial, ca. 1930**

Noa Nahmias  
York University

Popular Science was a pictorial published in Shanghai from 1933, which drew readers in with colorful covers and abundant use of images. Many of its images came from foreign popular scientific publications, alongside locally-made photos and illustrations. Why were certain images changed and adapted, while others were not? This flash talk will present key examples of images from Popular Science magazine, and ask how did the “translation” of these image shape the meaning of popular science in Republican-era, urban China?

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**Science, Islam, and Colonial India: Exploring the Complexity Thesis in the Field of Science and Religion**

Sarah Qidwai  
University of Toronto, Institute for the History & Philosophy of Science & Technology

This talk extends historical investigations in the field of the history and philosophy of science and religion into the under-studied world of Islam and science in Colonial India. I will examine why it may be important to have a more global and comparative approach in the field.

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**Science, Nation, and War: Sino-American Scientific Cooperation in the 1940s**

J Megan Greene  
University of Kansas

With the advent of the Sino-Japanese War (1937-1945), many Chinese academic, industrial, and government scientists felt compelled to use their expertise to respond to national need and to contribute their talents to the national military and economic development efforts that were taking place in previously underdeveloped areas in western China. Their training often did not correspond well to actual need, and many Chinese scientists found it necessary to retool. To address this imbalance, scientists and bureaucrats alike sought assistance from foreign allies, and addressed proposals to foreign partners such as...
the United States for the creation of training programs and other scientific advising relationships with foreign partners. Still other Chinese who resided abroad but wanted to make their own contributions to the war effort facilitated these proposals and relationships by liaising with US government contacts and creating scientific/technical/cultural organizations aimed at supporting overseas Chinese and furthering the interests of the Chinese nation. After the United States joined the war in 1941, with the encouragement of overseas Chinese facilitators, the US government became increasingly invested in responding to such proposals and in providing scientific and technical training and advice, as did numerous American scientists who worked during the 1940s as advisors and trainers. Through exploration of a set of short case studies of both Chinese and American scientists and government and non-government institutions, this paper illuminates the complex web of relationships that developed amongst these scientists, bureaucrats, and facilitators.

Scientific Facts Embedded in Christian Teachings

Myrna Perez Sheldon
Ohio University

How does scientific knowledge gain authority in relationship to other ways of knowing? Standard narratives of modernity assume that science expands through secularization; as scientific facts and theories emerge to explain natural and social phenomena, these are thought to replace explanations offered by religions, indigenous traditions, the humanities, etc. What is overlooked in this narrative is the role that these other modes of knowing have and continue to play in shaping and authenticating science within various communities. This was especially true in the context of the emergence of the biopolitical state; by the late 19th century “facts” from the new hereditary sciences were woven into pronatalist religious and nationalist movements throughout the world. These larger movements both made sense of, and grounded the authority of, the new eugenic sciences. This paper analyzes one example of this from a sermon contest convened by the American Eugenics Society in the 1920s. The AES offered cash prizes to American pastors to write and preach sermons on the topic “Religion and Eugenics--Does the Church have any responsibility for improving the human stock?” The records of these sermons, preserved in the AES papers, reveal how substantively Christian teaching was utilized to articulate and promote the moral imperatives of American eugenics--to preserve and protect the hereditary purity of the American racial stock.


William Vogel
University of Minnesota

This paper focuses on the construction of a transnational community of scientific critics of biological weapons research in the late 1950s and 1960s. First initiated in 1957, the Pugwash Conferences were a transnational venue for scientists to discuss and criticize the Cold War arms race, which emerged as an increasingly important element of informal Cold War diplomacy as the 1960s progressed. Though the organization which coordinated the conferences was dominated by Anglo-American and Soviet physicists principally concerned with the nuclear arms race, these leaders actively sought to construct transnational networks of critical experts on other weapons of mass destruction, especially biological weapons. Beginning in the late 1950s, Pugwash leaders successful enlisted biologists, epidemiologists, and physicians like Martin Kaplan and Matthew Meselson to construct this community of expertise, which in turn served as an influential liminal space for critics of biological weapons research and contributed to the unilateral American renunciation of the biological weapons in 1969, and the negotiation of the Biological Weapons Convention in 1972. The significance of Pugwash in Cold War diplomacy has been documented by Matthew Evangelista, but his focus on a few case studies of activism leaves a scholarly lacuna in
Pugwash’s influential opposition to biological weapons. Drawing on the papers of Pugwash leaders and activists, my paper fills this lacuna, focusing on the twin questions of how a physicists’ organization so effectively constructed a community of biologists, and how this community constructed an authoritative body of critical knowledge in the face of pervasive military secrecy.

**Scientists’ Narratives**

Robert Meunier  
*London School of Economics and Political Science, UK/University of Kassel, Germany*

Historians of science have recognised that scientists use narrative in many different fields and different domains - not just in the most obvious domains of the natural historical sciences, or in development stories, but in accounting for reactions, in describing mechanisms, in making sense out of simulations, in piecing together complex social and ecological arrangements, and so forth. Historians have also paid attention to the ways narratives feature in how scientific work is communicated. This symposium investigates how scientists use narrative not just to structure their practices (of hypothesising, observing, and inferring), but in constituting the objects of their science. At this deeper level, we see how scientists make use of narrative in the realm of concept formation: that is, in framing, expounding, clarifying, justifying, and then developing, the concepts they create and use. Our research suggests that such narratives of concept formation are broadly as well as deeply based: they may be built upon empirical research problems, developed out of theoretical puzzles, emerge from attempts to make causal sense out of events, or to account for strange phenomena. The individual symposium papers consider the role of narrative in two late 19th century cases: Darwin’s use of narrative in developing the theoretical concepts of evolution and economists’ use of narratives to characterize their competing concepts of utility; and two mid-20th century examples where narratives are involved in developing concepts of gene action and the taxonomies of neuroscience.

**Scions and Rootstocks: The Chinese Honey Nectar Peach and the Grafting of Science, 1920s-1965**

Jongsik Christian Yi  
*Harvard University*

The knowledge of why people should eat fruit and how fruit should be grown and utilized has historically varied. Focusing on such questions, this paper examines the history of the “hometown of Chinese honey nectar peach,” Longquanyi district of the city of Chengdu. In the Republican era, new varieties of honey nectar peaches were grafted on Longquanyi soil as a result of transnational exchanges of knowledge among missionaries, Western and Chinese elite scientists, and local landlords. In the Maoist years, the state imposed particular ways of knowing and doing upon local peasants in the name of the building of socialism, while the peasants tried to adjust to fruit farming as subsistence agriculture on their own. Based on the case of Longquanyi peach, this paper suggests adding the metaphor of “grafting” to the vocabulary list of global history of science. Features of grafting techniques, namely the dependency of a scion of imported variety on a local rootstock and the visibility of artificial attempts to integrate existing differences, help us emphasize power dynamics of knowledge encounters and local actors’ adaptive agency. The metaphor of grafting does not essentialize the binaries of Western, modern epistemologies and those of indigenous and traditional by understanding the relationship of scion and rootstock as relative. Global flow of scientific knowledge can be imagined as a vast orchard filled with grafted trees plastered with bandages, rather than indistinguishably “entangled” stems and roots underground.

**Securing the Foundations of Theories without Physical Postulates: The Case of Quantum Mechanics**

Jan Lacki  
*Un Geneve, Switzerland*
The ideal strategy to secure the foundations of an empirically successful theory is to provide physical postulates on which it can then be unambiguously reconstructed. Identifying such postulates, especially when one wants them to be indisputable, may however prove difficult. Such is notoriously the case of quantum mechanics. What are then the alternative strategies to provide nonetheless the theory with some kind of foundational legitimacy? When its formalism is mature enough, one can try to supplement to foundational rigor showing that the mathematical structure underlying the theory is in some sense “necessary”. To reach this aim, one puts requirements on how the physical systems or situations are to be formally handled. One attempts then to show that the formalism of the theory is a solution, hopefully unique, of the latter. To achieve the proper sense of necessity and to avoid ad hoc justification, the requirements have to be as general as possible. On the other hand, they also have to be “natural” and no wonder that eventually the frontier between physical postulates and such formal requirements gets blurred.

This strategy has been used in the various axiomatizations of quantum mechanics. The talk will examine the rise of such approaches in the history of quantum theory and the (sometimes heated) debates that the latter prompted. Special attention will be given to the rise of the so-called Geneva School.

Seeing Climate in Motion

Deborah Coen
Yale University

By 1900, a wide range of schemes for mapping climate had emerged in Europe. What most of them had in common was the absence of weather. They represented climate as a static variable, a long-term average, in which phenomena on the time scale of weather—clouds, storms, and gales—were invisible. How could the dynamic nature of climate be made manifest? This presentation will explore the first maps that captured climate dynamics. Produced in Vienna in the 1880s, they were part of a broader burgeoning of thematic cartography in the multinational Habsburg Empire. The revolutions of 1848-9 impressed on Habsburg statesmen the political significance of modern nationalism, and they responded with a new ideology of supranationalism. Geography was one among several disciplines that aimed to survey the vaunted multiplicity of the Habsburg lands and to present its findings to the public, in the form of maps, atlases, panoramas, and museum displays. The simultaneously technical and political challenge of representing the natural and cultural diversity of this territory gave rise to a range of novel techniques, shaping disciplines from ethnography to climatology. Climate maps in the late Habsburg Empire represented climate as a phenomenon of circulation—a motor of unity in diversity—and highlighted its significance for human life.

Self-Fashioning: Clothing Technology, Ethnoscience, and the Arctic Expertise of Vilhjálmur Stefánsson

Sarah Pickman
Yale University

In his pathbreaking 1996 article, Michael Bravo called for greater attention to non-Western knowledge systems and how Western actors have tried to render these systems commensurate with Western science. This paper heeds Bravo’s call by examining this process of creating commensurability in the career of twentieth-century Arctic explorer, ethnographer, and former HSS president (1945-46), Vilhjálmur Stefánsson.

Having lived with Inuit communities, Stefánsson was an advocate for the superiority of Inuit technology, especially clothing, for Arctic life, and a critic of Canadian and U.S. government treatment of native Arctic peoples. But during the Cold War, he championed American military intervention in the Arctic and promoted Inuit-style dress for soldiers. He positioned himself as a clothing consultant for the military and military contractors, collaborating with the DuPont corporation to replicate Inuit garb in Western-style fabrics that could be mass-produced for
troops. Stefánsson’s seemingly contradictory projects were as much about respect for indigenous knowledge as they were about positioning himself as the consummate expert on Arctic life in a changing technocratic America: keeping his own expertise, made during an earlier era of science, relevant for the modern world. Drawing on materials from Stefánsson’s archives, this paper will demonstrate the importance of understanding the specific ways in which indigenous knowledge has been appropriated and made commensurate via twentieth-century science, including as part of scientific self-fashioning, and argue that notions of “bioprospecting” should be applied to a greater range of activities than just the development of contemporary pharmaceuticals.

**Servants of Two Masters: Translation of Arabo-Persian Natural Philosophy in Early Ming China**

Dror Weil

Max Planck Institute for the History of Science, Berlin

The fourteenth century constituted a significant moment in the history of Asia. The Mongol empire, which had earlier brought large parts of Asia under one roof and facilitated cross-regional movements of texts and artifacts, degenerated. In an attempt to re-unite China under uniform rule and re-establish sustainable imperial governance, the first Ming emperor commissioned translations of Arabic and Persian texts from a selection of applicable fields, such as astronomy, astrology and medicine. This translation project constituted not only an important link between the Yuan and Ming institutions, but also a rare bridge between Greco-Arabo-Persian natural philosophy and the late imperial China’s political and scientific traditions. Examining the two Chinese works Huihui tianwen shu ("The Book of Arabo-Persian Astrology") and Huihui yaofang ("Arabo-Persian Pharmacopeia"), both of which are translations of Persian treatises from the late-14th to early-15th centuries, this paper will bring to light the methods by which these Chinese translations negotiated, interpreted and presented the fundamentals of Greco-Arabo-Persian natural philosophy to Chinese readers. Situated between the disciplines of practical knowledge history, the history of statecraft and cultural studies, this paper will investigate the methodologies by which these translations aimed to transcend linguistic, cultural and epistemic boundaries, and mediated and negotiated meanings and methods of presentation in different media, in an attempt to produce knowledge applicable for governance.

**Sex as a Malleable Essence of the Body: Chinese Sexology, 1920-1940s**

Howard Chiang

University of California, Davis

In the aftermath of the New Culture Movement (1915-1919), Western-trained biologists in China helped establish a popular understanding of sex dimorphism that construed bodily morphology and function of the two sexes as opposite, complementary, and fundamentally different. Starting in the mid-1920s, urban Chinese intelligentsia began to construct a more fluid definition of humanity. They argued that at base, all humans are equal. They no longer drew on the limited language of anatomy to talk about two different but equal sexes. Rather, they started to think of men and women as simply two versions of a universal human body. They appropriated from Western endocrinologists the theory of universal bisexuality, which posits that everyone is partly male and partly female. This paper shows that a vibrant discourse about “sex change” existed in the mass circulation press of Republican China (from the 1920s through the 1940s). It traces how Chinese sexologists entertained the possibility of sex transformation based on a new hormonal vision of universal bisexuality and famous animal sex reversal experiments in Europe; it demonstrates how indigenous Chinese frameworks for understanding reproductive anomalies (hermaphrodites, eunuchs, etc.) provided an epistemological point of reference for communicating new and foreign ideas about sex; it assesses the impact of a highly sensationalized case of “female-to-male” transformation in mid-1930s
Shanghai on people’s awareness of the possibility of human sex change; and it analyzes the culminating effects of these epistemological reorientations in a science fiction short story called “Sex Change” (1940) by the pedagogical writer Gu Junzheng.

**Sex Beyond Humans: Finding a Queer Ethology in Naomi Mitchison’s “Memoirs of a Spacewoman”**

Caitlin McDonough  
*Syracuse University*

Naomi Mitchison co-authored her first, and only, scientific paper in 1915 with her brother JBS Haldane. In her memoirs, Mitchison describes feeling pushed out of science because she was more interested in the behavior and personality of her subjects than their genes. She went on to pursue a lauded career as a writer and activist and later used fiction to reclaim the scientific realm denied in her youth. In her science fiction novel Memoirs of a Spacewoman, published in 1962, Mitchison imagines research on animal behavior free from both the boundaries of Earth and the strict scientific culture she experienced. Mitchison created species that contravened pre-conceived notions of sex, sexuality, and motherhood. Her protagonist uses research methods of communication that embrace extreme empathy, erase the barriers between a scientist and their study system and thereby breaks the rules separating observer and observed. Memoirs of a Spacewoman can be embraced as a queer text that agitates the dominant scientific enterprise, shows that the scientific definitions and perspectives on sex are limited and inadequate, and explores alternative methods to science.

**Simulated Knowledge, Simulated Time**

Janina Wellmann  
*Leuphana Universität Lüneburg*

In recent years, computer simulations have become ubiquitous in science. They work with huge sets of data, are technologies to study processes, events or behaviour and introduce ways of doing science other than through observation, experiment or theory.

In my paper, I will study the use of computer simulations in the modern life sciences. By examining life computationally, modern systems biology aims at a new complexity of investigation, integrating information from the micro-level of molecules to the whole organism and its environment.

In particular, I will investigate the different time scales operating in simulations of biological processes. Knowing when and what are intricately entwined and play out at various levels in these combined experimental-computational set-ups: the time of the organism, the time of the simulation and the time of the scientist. My discussion will focus on the question whether simulations are new tools to integrate these various dimensions of time into a new understanding of the organism as a whole.

**Simultaneous Discovery or Competing Concepts? Economists’s Notions of Utility in the Late 19th Century**

Mary Morgan  
*London School of Economics*

Economists developed the concept of ‘marginal utility’ in the late-nineteenth century within several different ‘schools’ of economics. Their ideas have been seen as sufficiently similar that historians of economics have sometimes taken this to be a case of simultaneous discovery - by four different economists (Menger, Clark, Jevons and Walras) in four separate countries (Austrian, America, Britain and France). They are thought to have developed this notion out of an older tradition of thinking about ‘use-value’, and this may account for why the similarities in their versions stood out for later commentators. Although they used the same labels, their accounts of utility were sufficiently different to make them conceptually distinct. These four versions were each associated with different characteristics of individual and social behaviour, which had salience for the theoretical context in which they were embedded. These characteristics are best revealed, and so traced, not in debates between the economists but rather in the separate narratives that they each told, first in
introducing their version of ‘marginal utility’, and then in developing the characteristics of their concepts. This comparison explores how such late-nineteenth century economists’ narratives provided not only the wrapping, but much of the substantive content and format of their concepts-in-development, as well as carrying important implications for the mode of reasoning thought allowable in using their different versions of the concept.

Sinful Bodies and Global Catastrophe in Early Modern Italy

Lydia Barnett
Northwestern University

In 1584, a short and remarkable book appeared in print: Letters on Natural Philosophy, written by a Paduan apothecary named Camilla Erculiani. Recently-rediscovered after centuries of obscurity, this book is the only work of natural philosophy published by a woman in sixteenth-century Italy that we currently know of. It may also be the first work published in Europe by an author of any gender to offer a systematic account of the human capacity to cause catastrophic harm to the global environment. Erculiani placed the blame for such a planetary catastrophe squarely on the human body. Citing Galen and the Book of Genesis while also drawing on her own expertise as a medical professional, Erculiani argued that mankind’s divinely-created physical embodiment had destroyed the natural equilibrium of elements and triggered the global disaster of Noah’s Flood—a process which she feared might be repeated in the near future as the human population of the earth again grew too large for the planet to bear. This paper situates Erculiani’s unique contribution to Renaissance science and medicine at the confluence of several powerful forces in 16th-century Europe, including the Reformations, the Little Ice Age, the Scientific Revolution, and Renaissance feminism. In its emphasis on embodied sin as a world-changing force, Erculiani’s Letters on Natural Philosophy illuminates the crucial role of religious belief in the emergence of an environmental consciousness which linked the imperfection of the human body to the degradation of the global environment.

Sino-Foreign Scientific Relations from Republic to People’s Republic: Transnational Connections and Movements

Gordon Barrett
University of Oxford

China has often been treated as a peripheral or isolated case in the history of science. This panel challenges such narratives of separateness and instead explores the ways in which science in China has been linked and integrated into wider international currents and transnational networks. It does so through a series of papers that explore important individual, institutional, and governmental relationships that helped to shape the trajectory of Sino-foreign scientific relations during the twentieth century. These include examples of international mobility, ranging from the activities of foreign physicists at Yenching University during the Republican era (1911-1949) through Sino-American scientific cooperation during the Second World War to British scientists’ highly politicized visits to the People’s Republic of China in the decades following the Chinese Communist Party’s rise to power in 1949. The complex relationships between states, scientists, and international organizations are further explored through papers examining Chinese scientists and scientific associations’ international activities. Collectively, the papers in this panel provide opportunities to consider crucial points of both continuity and change in Sino-foreign scientific relations across the twentieth century alongside the impacts and legacies of imperialism, war, and revolution.

Social Amoebas and the Evolution of Altruism in the 21st Century?

Tania Munz
National Humanities Center

Charles Darwin famously puzzled over how to explain altruistic behaviors in animals and humans: Entire
castes of social insects dedicate themselves to the good of the colony but are themselves sterile, while humans who save the lives of others might not live to pass on to their children such noble inclinations. How, he wondered, did such selflessness evolve in a world that seemed to overwhelmingly favor fitness above all else? Historians and philosophers have done much work to trace how scientists have sought to come to grips with altruism and its ugly twins, selfishness and cheating, over the course of the nineteenth and twentieth centuries. This paper looks at more recent studies that rely on the social amoeba Dictyostelium discoideum (better known as slime mold) and their bacterial symbionts to investigate altruism. The paper is especially concerned with how slime mold scientists study the phenomenon across different time scales—through genetics, experimental evolution, and game theory. It seeks to place this work in the social and cultural context of the history of altruism by asking what work complex moral concepts (such as selfishness, cooperation, and cheating) must do when applied to the lowly slime mold.

**Some Assembly Required: Building Whole-Body Catacomb Saints in Early Modern Bavaria**

Noria Litaker

*University of Nevada, Las Vegas*

After the “rediscovery” of the Roman catacombs in 1578, the Catholic Church began exporting the relics of early Christian martyrs across Europe and beyond. Between 1578 and 1803, the duchy of Bavaria received almost 400 of these “catacomb saints,” whose sparkling bodies still rest on altars across the region to this day. In almost every case, however, churches did not receive whole skeletons from the catacombs and what appear to be full bodies are, in fact, complicated constructions made from available bones and meticulously carved wooden replacements.

How and why did early modern Bavarians build such bodies rather than leaving them in pieces? Using several case studies, this paper will examine the construction and decoration process required to transform bone fragments into “holy bodies,” with special attention to the materials, medical and artisanal knowledge and labor that was required to create them. I will demonstrate that the creation of these bodies was a team effort including artists and physicians familiar with human anatomy; carpenters and metalsmiths who carved missing bones and built custom support structures for the “bodies;” and nuns skilled in the decorative technique known as Klosterarbeit (cloister work) who covered the saints remains in jewels, pearls and gilded wire. In closing, I will briefly discuss why early modern Bavarians so insistently presented these saints as whole bodies, arguing that this approach facilitated both the development of intensely local cults and tied these communities to larger movements in the post-Reformation Catholic Church.

**Soups and Sparks, Round II: Narrative Explanations and the Conceptualization of ‘Synapse’**

Corinne Bloch-Mullins

*Marquette University*

In this paper, I discuss the case study of the concept ‘synapse’, focusing on a debate that took place during the mid- to late- 20th century. The ‘war of the soups and sparks’, in which scientists attempted to determine whether synaptic transmission is electrical or chemical, had just ended. The resolution of the battle over facts, however, cleared the way for a new battle—one that was fought over concepts. Specifically, scientists disagreed about the extension of the concept ‘synapse’: while some argued that the term should apply exclusively to chemical junctions, others maintained that it should extend to electrical junctions, as well. I analyze the work of neuroscientists from both sides of the debate, most prominently Harry Grundfest and Michael Bennett. I show that what was at stake, for them, was not merely terminology. Rather, each of these alternative conceptualizations was intertwined with the production of a narrative explanation. First, each taxonomy brought to the foreground distinct similarities and dissimilarities, highlighting specific ‘why’ or ‘how’ puzzles that arose from these relations.
Each taxonomy, therefore, reflected not only the integration of known facts about the objects of investigation, but the scientist’s views about the most pressing and interesting questions to be asked. Second, these taxonomic juxtapositions illustrated a preliminary roadmap for solving such puzzles through empirical research. Thus, the alternative conceptualizations of ‘synapse’ each build upon—and, in turn, contribute to—the production of narrative explanations.

South Korean Biologists’ Memory and Use of Japanese Colonial Experience

Manyong Moon
Chonbuk National University

During the Japanese colonial era (1910-45), biology was the scientific field in which the largest number of Korean researchers was active. Korean biologists trod diverse paths of academic growth, encompassing both those who had majored in the discipline at universities and those who had developed as biologists while working as apprentices of Japanese researchers. This presentation will track how several researchers who had graduated from universities during the colonial period and were active as key figures in South Korean biological circles after the Liberation (1945) remembered and used their experiences related to biological research during the colonial era. Especially, it will elucidate how plant physiologist Lee Min-Jai (1917-91), ichthyologist Jeong Mun-Gi (1898-1995), and entomologist Kim Chang-Whan (1920-2013) assessed and understood the legacy of colonialism by examining the different ways in which these figures reflected their respective careers and research data during and from the colonial period in their post-Liberation research activities. As such, this will be both an approach to the analysis of the formation of modern biology in South Korea and one of the specific attempts to evaluate the colonial period in the overall history of science in Korea.

Spatters and Lies: Technologies of Truth in the Sam Sheppard Case, 1954-1966

Ian Burney
Centre for the History of Science, Technology and Medicine, University of Manchester

This talk considers the contrasting forensic regimes involved in the celebrated 1955 trial and 1965 re-trial of Dr Sam Sheppard for the murder of his wife Marilyn. The first regime cohered around the Cleveland Coroner Sam Gerber, who took charge of the scene investigation, conducted a highly-publicized inquest, and provided sensational trial testimony which included his claim to have recognized the pattern of a ‘surgical instrument’ impressed on Marilyn’s bloody pillow. A second regime developed in the wake of Sheppard’s conviction and centered on the Berkeley criminologist Paul Kirk. Kirk provided an alternative, but equally striking, reading of the blood evidence: where Gerber saw qualitative, holistic shapes, Kirk deployed a pioneering (and since celebrated) exercise in spatial reasoning based on the emerging discipline of blood spatter analysis.

The acquittal of Sheppard at his 1966 retrial could be seen as an instance of modern forensic technique as a catalyst for justice—with analytical and objective methods overcoming judgements based on mere common sense and local interest. I will suggest that this simple story obscures the more interesting—and surprising—route taken by those seeking to establish Sheppard’s innocence. In this campaign it was the polygraph rather than spatter analysis, and the detective writer Erle Stanley Gardner and the flamboyant defence attorney F Lee Bailey rather than Kirk, that took center stage. This twist, I will suggest, allows us to reflect on the inherently complex relationship between forensic facts and the broader context within which they are produced and

Standards and Experts: Knowing and Regulating Risk

Colleen Lanier-Christensen
Harvard University

In the contemporary world, regulating drugs, food products, consumer goods, and occupational hazards requires evidence. The basis on which such evidence
should be considered reliable and valid gets to the heart of authoritative knowledge production. In mixed settings of regulatory bodies—a confluence of industrial, bureaucratic, legal, and academic work—how has this evidence been judged? Over the 20th century, regulators have relied on experts to protect consumers and workers from risky foods, drugs, consumer products, and occupational hazards. They have developed regulatory systems assuming that if frameworks and evidentiary standards are set correctly, reliable knowledge and protective practices will follow. Yet, time and again, risky products and exposures have resisted smooth bureaucratic control. Amidst a confluence of sometimes competing political, economic, and epistemic concerns, how have interested parties legitimated policy decisions? This panel addresses a set of questions related to knowledge for regulation such as: how standards have been used to try to ensure the reliability of data; what regulators have done when evidence was inadequate or inconclusive; how competing value systems have been negotiated; and what has happened when risks did not conform to existing classifications. The papers examine international efforts to regulate toxicological laboratory practice, fetal protection policies in the U.S. industrial workplace, and U.S. Food and Drug Administration food and drug labeling practices. The session aims to generate discussion about how risk and responsibility have been formed and reformed, what has counted as evidence, and the sometimes surprising ways power has been instantiated in bureaucratic settings.

**Strange Tales from the Unseen World: A Confluence of Systems of Understanding in Stewart & Tait’s the Unseen Universe**

Mason Tattersall  
Oregon State University

In 1875 Balfour Stewart and Peter Guthrie Tait published The Unseen Universe, an odd book that attempted to combat materialism by using the newly formulated law of the conservation of energy to rationally explain supernatural ideas like miraculous happenings, the immortality of the soul, Christ’s Incarnation, angels, and more. Stewart and Tait accounted for these supernatural ideas and addressed the worrying prospect of the heat death of the universe by proposing a second, unseen universe that was tied to the seen universe through bonds of energy transference. The book represents an attempt at the reconciliation of several contradictory and complimentary systems of understanding into a new unified synthesis. This paper will present a brief introduction to and systems-based analysis of this odd work of natural philosophy, placing it in its scientific, cultural, and philosophical context, and by doing so will provide a glimpse into the broader world of competing systems of understanding in Victorian science, rife as it was with philosophical non-simultaneity and intellectual ferment. By taking a systems-analytical approach to a complex text like this we can gain insight into the ways in which competing systems of understanding interact in times of intellectual change.

**Stressed Minds: Cybernetics and the Language of the Mind in the mid-Twentieth Century United States**

Angelica Clayton  
Yale University

This paper is a history of how “language” became a model for thought from the 1950s through the 1980s and specifically how cybernetic ideas of communication and stress pushed for the possibility of an internal language of thought. The paper begins with an introduction of psychological and cybernetic ideas of “communication” and the work done on stress in the psychological sciences during the 50s and 60s, influenced by ideas of Cold War fear and brainwashing. Cyberneticists discussed stressed systems as having problems in external and internal communication, and research on psychological stress drew from these cybernetics-based definitions. Researchers created models of “stressed minds” that rested on the breakdown of communication and ideas of diagnosis as the accessing of the state of the system, in the mathematical or psychological sense, through
“noise,” that unintentional communication or behavior created by stress.

These models of stressed systems, either cybernetic or psychological, explicitly introduced the question of an internal language of thought. To discuss stress as hindering communication, particularly internal communication, some type of internal logically-consistent language must exist. For cybernetic systems, this could mean the programming language being used, but the question still remained; was there an internal language of thought? The 1970s saw a surge of debate surrounding the existence of this internal language, most clearly in Jerry Fodor’s Language of Thought Hypothesis. This paper aims to show how cybernetic influenced models of stressed minds contributed to these language-type models.

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**Surgeons and Disease in Sixteenth-Century Spain: Peste and Morbo Gallico in Surgical Texts**

Kristy Wilson Bowers

University of Missouri

In the late sixteenth century, a number of university-educated surgeons in Spain began producing vernacular surgical manuals designed to provide the most recent knowledge in surgical treatments to practicing surgeons who could not read Latin. These texts are notable in their number and diversity of authors as well as for the fact that many include discussions of diagnosis and treatment of diseases including peste (plague) and morbo gallico (syphilis). These two diseases are, in a way, hallmarks of the premodern era; plague arose in epidemic form in the fourteenth century and morbo gallico in the late fifteenth century. As “new” diseases that often appeared changeable in nature, both gave rise to continued debates over their causes, the means by which they spread, and best methods of treatment. As diseases that produced external and visible symptoms of rashes, sores or buboes, they increasingly fell under the care of surgeons. This paper analyzes the way these diseases were understood and treated by surgeons in late sixteenth-century Spain. While many studies have examined the initial responses of medical personnel to these diseases in their earliest centuries, there has been less attention paid to later evolving ideas of causation, spread and treatment. These vernacular texts are significant in providing a window onto how experience and empiricism shifted perceptions of each disease, and how learned balances and scratch tests, when making such determinations. Indeed, one of the central theses of this paper is that while Beckmann was uniquely positioned to acquire “knowledge of the handicrafts,” due to his growing reputation as a scholar of Technologie, many late eighteenth-century antiquarians shared his interest in artisanal epistemologies. Some even wrote histories of inventions, wherein the making and measuring of coins (not surprisingly) occupied pride of place.

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Johann Beckmann (1739-1811), Professor of Oekonomie at the University of Göttingen, is often hailed as the founder of modern technology studies. But what can be said about Beckmann as an antiquarian? In this paper, I will discuss Beckmann’s longstanding interest in precious metals and his efforts to develop a more “scientific” approach for analyzing metal objects, especially gold and silver coins. As I will argue, this approach consisted of an amalgam of philological inquiry, visual analysis, and experimental practice, and was used by Beckmann to quantify the object(s) under investigation. He was particularly interested in finding a way to establish the ratio between pure gold or silver and the metal alloys that were used in the minting of coins. Like many antiquarians, he believed that such a ratio could be used to distinguish the authentic productions of ancient peoples like the Greeks and Romans from the many forgeries that were beginning to flood the market. What distinguished Beckmann—or did it?—was his willingness to use tools and techniques that had long been known to artisans, such as hydrostatic balances and scratch tests, when making such determinations. Indeed, one of the central theses of this paper is that while Beckmann was uniquely positioned to acquire “knowledge of the handicrafts,” due to his growing reputation as a scholar of Technologie, many late eighteenth-century antiquarians shared his interest in artisanal epistemologies. Some even wrote histories of inventions, wherein the making and measuring of coins (not surprisingly) occupied pride of place.
practitioners sought to codify and pass on this knowledge to their present and future colleagues.

Swimming on the Page: Marcus Å%lieser Bloch and his Natural History of Fishes

Didi Van Trijp
Leiden University

This paper centres on the oeuvre of Marcus Å%lieser Bloch (1723-1799), a Jewish physician living in Berlin. Bloch authored the Allgemeine Naturgeschichte der Fische, a natural historical series on fishes consisting of twelve volumes published between 1782 and 1794. These books are lavishly illustrated and each image has been coloured in by hand. The series is based on Bloch’s extensive collection of fish specimens. This assemblage consisted of fishes from the German regions and a large amount of “foreign” fishes. Although these foreign fishes came from places all over the globe, a significant share of them originated in Malabar, India. This was due to the presence of German missionaries in this area. The letters of these missionaries, and mostly that of Father John (1747-1813) held by the mission’s archives in Halle, Germany offer some interesting insights in the process of collecting fishes, in which local fishing communities played a considerable role. Once caught, the fishes were dispatched to Bloch in Berlin, who in turn converted them into text and illustration with the help of artists and engravers. This paper studies the process in which fishes were swept up from the seas, preserved, collected, classified and represented in word and image. In doing so, it elucidates how the various steps in this process affected the knowledge that the book presented of the submarine world.

Taíno Nation: Puerto Rican Archaeology in Translation

Darryl Brock
City University of New York

Archaeological research in Puerto Rico has sought to understand the Taíno Amerindians and their predecessors. The Spanish Empire of the 16th century essentially wiped out these indigenous peoples, but by the 19th century aboriginal archaeological artifacts were being catalogued in Puerto Rico. The leading colonial scientist of the waning Iberian authority, physician-botanist Agustín Stahl, boasted the island’s largest archaeological collection. His work inspired other amateur Puerto Rican archaeologists, members of the insular elite. These professionals conducted serious archaeological work, but nevertheless represented non-expert researchers. That is, none of these workers were trained as archaeologists. During the early days of American colonial oversight, after the 1898 annexation, U.S. archaeologists continued Stahl’s work of understanding Taíno origins. In fact, they cited such local work, often already published in the archaeological literature. Building on indigenous professional expertise, these American archaeologists translated local expertise, validated it, re-interpreted it and expanded it. By the 1950s, when Puerto Ricans had established an autonomous, self-governing polity under U.S. jurisdiction, the Puerto Rican Institute of Culture positioned itself as the scientific authority over archaeology, now setting insular research agendas. In essence, local archaeological experts now re-translated American-led work of the early 20th century, recruiting it into notions of cultural nationalism. That is, Puerto Ricans imagined themselves as a Taíno Nation, an indigenous peoples infused with genetic and cultural additions from European and African sources. Recent Puerto Rican archaeological success has thus contributed to a unique cultural accommodation against frustrated political independence.

Technocracy in Translation: Administering the Russian Enlightenment

Maria Avxentevskaya
Max Planck Institute for the History of Science, Berlin

The figure of Tsar Peter I of Russia (1672-1725), a reputed reformer of the early Russian state, has many times become such a plastic signifier as to convey different kinds of symbolism for different political purposes. However, many authors agree that the
formidable pace of Petrine reforms caused a genuine struggle to construct a new language of Russian technocracy—an instrument for the sovereign power and collective actions. Disproportions between the novelty of the emerging technological reality in Russia and the archaic Church-Slavonic language of the government created a characteristic clash between res et verba. Peter’s “politics of neologisms,” which also invoked new methods of visualization and quantification, shaped national and cultural identity, and induced pedagogical and institutional discussions. My paper will examine how the state-supported procedures of technical translation influenced the administering of the early Russian Enlightenment. I will argue that Peter’s adopted strategies and procedures of technical translation in the linguistic sense played a role as a factor in translation in the sense of building a new bureaucratic system—a Leviathan that would soon grow into a European empire. Peter’s intentional approach to translation prioritised the practical knowledge of how to perform concrete manual operations but not the conceptualization of skills, which slowed down the institutionalization of knowledge practices and the evolvement of continuous legal frameworks for sustainable bureaucracy. My contribution will conclude by considering the impact which was thus generated for the subsequent development of the Russian version of imperial humanism.

**Technology and the Occult from Oppenheimer to ARPANET**

Benjamin Breen  
UC-Santa Cruz

During the past two years, the internet seems to have taken a turn toward the occult (a term which, in its original incarnation, simply referred to concealed knowledge). The darkly conspiratorial mindset of contemporary digital culture is not entirely new, however. In this paper, I explore a set of submerged connections between California tech culture and occult traditions which date back to the early modern period. Jack Parsons, for instance, helped found the Jet Propulsion Lab at Cal Tech even as he led the West Coast branch of Aleister Crowley’s Ordo Templi Orientalis in acts of ritualistic “sex magick” and attempts to summon Babylonian demons. These overlapping interests, I argue, were not atypical in the middle decades of the twentieth century. Physicists like Robert Oppenheimer immersed themselves in mysticism, while new religions like Scientology advertised their “technologies” in periodicals like Popular Mechanics. Reconnecting the occult tradition with the history of science sheds new light on the social and mental worlds of twentieth century technological change. Going forward, it might also help guide us through an uncertain future in which techniques like machine learning proceed beyond the realm of human intelligibility and become re-inscribed with the divinity (or demonology) of the occult.

**Territories of Finance: Martin Wagner, German Economics, and Postwar US City Planning**

Anna Vallye  
Connecticut College

Martin Wagner (1885-1957) was a leading city planner of the Weimar Republic, chief planner for Greater Berlin (1926 to 1933), planning theorist, and mastermind of social housing ventures. Relocating in 1938 to the United States, where he taught at the Harvard University Graduate School of Design, Wagner promoted a conception of planning shaped by his experiences in the nascent German social democratic welfare state. His ideas then evolved in the context of the regulatory and interventionist policies of American New Deal and wartime mobilization. In both Germany and the US, Wagner’s approach to planning was in dialogue with economics science, in its role as instrument and shaper of territorial governance. His 1915 doctoral dissertation co-advised by economist Julius Wolf, Wagner went on to develop a concept of the city as financial organism, situated in a regional framework subject to managerial governance. His ideas were built on the structural overlap in the systems of market and political
organization theorized by German thinkers such as Max Weber, Werner Sombart, and Rudolf Hilferding. As planning practitioner, he extended to urban territory forms of public-private interplay that defined the Weimar “social economy.” In dialogue with American Keynesian economists, including Alvin Hansen, Wagner would elaborate his approach to the urban fabric as reified fiscal policy. However, his regulatory conception of real estate and advocacy of public land ownership ultimately condemned his theses to obscurity in postwar America.

Xiaoxing Jin
University of Notre Dame

The first two decades of the twentieth century were not a golden age for the reception of Darwinism. Sir Julian Huxley (1887-1975) and Peter Bowler (1944-) developed the descriptor, “the eclipse of Darwinism,” to explain the state of affairs prior to the “modern evolutionary synthesis” of genetics and the theory of natural selection. The reception of Darwinism, during this period in China, has not been well explored by academic scholars. The “eclipse,” if it did happen, never stopped or delayed the pace of the development of biology in China. In this paper, I will investigate the development of science, particularly biology, by describing the establishment of the Science Society of China in June 1914, and its official publication, Kexue (lit. Science), which remained the major, if not the only, intellectual site for Chinese biologists to debate Darwinism. I will illuminate the dissemination of evolutionary ideas through the creative discussions in Kexue, in the 1910s, to test the hypothesis of an “eclipse” in a Chinese context and seek a possible answer to the question of why Chinese biologists had little interest in the translation of Darwin’s Origin of Species in the 1910s.

Daniela S Barberis
Shimer Great Books School, North Central College

This paper focuses on a specific aspect of the efforts of Durkheim and his colleagues to institutionalize sociology as a scientific research discipline in France in the late nineteenth century: the graduate training of the emerging sociologists. This training posed several challenges at its inception, such as the lack of a formal program of education and of dedicated faculty or facilities. One way that Durkheim and his associates worked around their relative lack of resources was through the foundation of the Année sociologique. This journal was a discipline building enterprise: it was a collective undertaking, it discussed a wide variety of material, and it organized the intellectual division of labor in a number of subfields, effectively defining the discipline of sociology by its choices of authors and books for review. Durkheim, as the hub of the enterprise, and Mauss, as his closest collaborator and “alter ego,” reviewed all copy, suggested revisions and insisted in examining everything in the smallest detail. This extensive work of editing formed the style of professional review writing of his collaborators. Durkheim encouraged and directed the research work of his younger teammates, providing them with guidance in creating original articles in the field of sociology, offering models of scientific research in the field, and helping them obtain academic appointments. I examine the practices of training in writing, their transfer across generations, and their significance to the success of the group.

Antony Adler
Carleton College

Cobb Seamount, first discovered in 1950 off the coast of Washington, was the focus of a multi-year scientific research program named “Project Sea Use” from 1968
until 1975. This collaborative effort, involving private industry, state government, and the U.S. military, aimed to install a manned underwater habitat in international waters on the summit of a submerged volcano. Ultimately, the aims of “Project Sea Use” were never fully realized, but the story of this ill-fated endeavor reveals important scientific, political, and military characteristics of marine research at the height of the Cold War. “Project Sea Use” embodied the hopes and fears of a generation of scientists, explorers, and politicians who envisioned a near future when humans would colonize the seafloor. The oceans presented a new frontier for exploration and seemed to promise untapped natural resources. But accompanying this fantasy was the nightmare of an overpopulated earth, thermonuclear war, and new forms of colonial competition between maritime nations.

The Biogeological and Cartographic Dimensions of Darwin’s Coral-Reef Theory

Ali Mirza
Indiana University, Bloomington

Darwin’s theory of Coral Reefs, developed between 1835 and 1842, is commonly interpreted as subservient to his geology—constructed in order to provide evidence of subsidence contrary to the elevation he witnessed in South America. Recent work has broadened Darwin’s motivations to the day-to-day affairs of hydrography and emphasized his reliance on plant biology. In this paper, I have two primary goals: (1) to bring out the hydrographical elements to their fullest extension by showing why the features of coral reefs Darwin targets were so critical for the Admiralty at an institutional level, partly due to the work of its first Hydrographer, Alexander Dalrymple (1737-1808), and to make clear how such programmatic influences determined the earliest articulation of Darwin’s theory. And, (2) to show how solving the hydrographical problems provided by the Admiralty required Darwin to apply and develop a robust, biological notion of a “station” which captured the different kinds of coral along with their ecological role. For the Admiralty coral reefs served as instruments—their structure helping to predict the weather patterns a ship Captain could hope to encounter. Because Darwin’s concept of a station was highly relational and sensitive to ecological perturbations, this led him to repeatedly conclude that the structure of coral-reefs was not always useful in predicting surrounding conditions or where yet unknown coral reefs might lie. Such ecological considerations heavily constrained what could be learned about the geology/hydrology of a particular region from its reefs.

The Castle-Pearl Controversy, 1915-1917: Practical Breeding and Experimental Genetics in the United States

Sunguk Jung
University of Toronto

This paper examines the controversy between two early American geneticists, William E. Castle (1867-1962) and Raymond Pearl (1879-1940). Scientific controversies among US geneticists have attracted relatively little attention because historians have mainly seen early American genetics as dominated by Thomas Morgan’s “Fly Room” at Columbia University. Focusing on Morgan’s fly genetics has led historians to undervalue the importance of the agricultural context in the development of genetics in the United States. However, a majority of early American geneticists worked at agriculture-related institutions, and they argued over theoretical and practical issues relevant to agriculture. The Castle-Pearl controversy offers a revealing example. At the time the controversy unfolded in 1915-1917, both Castle and Pearl were working on agriculture-related genetic experiments at agricultural institutions: Castle at Harvard’s Bussey Institution and Pearl at the Maine Agricultural Experimental Station. While their experiments had the same goals—testing genetic theories and developing practical breeding methods—they reached different conclusions about several critical issues: the validity of the pure-line theory, the efficacy of mass selection in practical breeding, and the role of natural selection in evolution. As they
admitted, their diverging views derived from their different interpretations of their own breeding experiments. The central question is: What led Castle and Pearl to interpret their experiments in different ways? To answer this question, I focus on the implications of practical breeders’ knowledge and breeding techniques to the research conducted by Castle and Pearl, in order to draw a more detailed intellectual and institutional map of early American genetics.

The Chinese Role at the Beginning of the World Federation of Scientific Workers, 1945-1950

Xiao Liu
University of Chinese Academy of Sciences

This paper examines the international and political background of the creation of Chinese Association of Scientific Workers, expounded its active role in the establishment and early activities of WFSW based on archives. As a new kind of scientific group, the AScW involved political affairs with profound international characteristics of that era. The Chinese AScW united the international and inland progressive intellectuals, prompted the transformation of the scientific institution and organization of scientific activities. More than an important window for China to keep relations with western science, the WFSW laid the foundation of the Sino-British official scientific communication. Meanwhile, the Chinese role in the WFSW was subject to the Sino-Soviet relationship.

The Common Origins and Changing Interpretations of the Concept 'Fact' in German Physics and Historiography

Sjang Ten Hagen
University of Amsterdam

I discuss the emergence and early history of the concept ‘fact’ in German learned culture around 1800, particularly in physics and historiography. I argue that the fact-oriented methods of German physicists and historians were of common historical origin, by showing that the concept ‘fact’ was adopted by historians and physicists more or less simultaneously and for similar reasons. In the late eighteenth century, the concept ‘fact’ developed as part of a ‘historical’ repertoire, which comprised both human and natural fields of empirical study, and which was increasingly sharply contrasted with philosophy and speculative methods. In a context of scientific and political revolutions, facts were generally regarded as eternal knowledge, and put in contradistinction to short-lived theories. I demonstrate how a fact-based epistemology emerged at the University of Göttingen, by focusing on August Schlözer and Georg Lichtenberg. They construed facts as the empirical basis of ‘science’ (Wissenschaft), but not as science itself. From the beginning of the nineteenth century onwards, however, facts increasingly began to be seen as having self-contained value, both in physics and in historiography. While the modern disciplinary system took shape, a new generation of historians and physicists embraced facts, as extracted from either archival or experimental study, as the essence of ‘scientific’ (wissenschaftliches) knowledge. This history of the ‘fact’ exemplifies that, while establishing autonomous academic disciplines, scientists and humanists drew upon similar conceptual repertoires.

The Controversy over the Comets of 1618: Reflections for the 400th Anniversary

Kraig Bartel
University of Oklahoma

2018 marks the 400th anniversary of the controversy over the comets between Orazio Grassi and Galileo Galilei. The appearance of three comets in 1618 initiated a scientific and polemical exchange between the two. A central issue of the debate was the location of the comets, either above or below the lunar sphere, and the role of observational evidence in contemporary cosmology and natural philosophy. The debate over the comets had implications for the substance of the heavens, the existence of change and corruption in the celestial region, as well as the utility of mathematical demonstrations for natural philosophy. However, historians of science have not
fully explored the religious, political and scientific import of this episode in the history of science. The most glaring omission in the historiography is the ease with which historians of science have glossed over Grassi’s final response to Galileo, his Ratio ponderum librae simbellae (1626 Paris, 1627 Rome), for example Drake and O’Malley excluded any translation of Grassi’s last response to Galileo and instead chose to include a translation of Kepler’s Hyperaspistes in their 1960 publication The Controversy on the Comets of 1618. In this paper I will explore the connections between the scientific, religious and political aspects of the controversy with special emphasis on its import for the history of Jesuit science and the role of the Society of Jesus in the development of early modern mathematics and natural philosophy.

The Cyclone and the Calorie: Gender, Diaspora, and the Biometric Subject in Mauritius and the Greater Indian Ocean World, 1940s-1950s

Robert Rouphail
University of Illinois at Urbana-Champaign

In the early 1940s, the British colony of Mauritius found itself in a precarious position. The 1942 Japanese occupation of Burma and a powerful cyclone in Bengal the same year shattered the rice economy of the Indian Ocean. Not three years later, three cyclones in 1945 pushed the Mauritian sugar economy to the brink of collapse and unleashed a colony-wide outbreak of poliomyelitis. Anxious about the potential political crises sparked by a hungry population and growing concerns over disaster recovery, chronic malnutrition, and disease, the colonial state attempted to reshape the domestic nutrition systems of its agricultural poor. This was done by identifying women as the vectors through which to change social patterns of food production and consumption. In addition to building an ethnographic infrastructure to understand the social worlds of Mauritian women, colonial researchers also collected biometric data -- blood samples and splenic studies -- data that became an archive around which the development of the colony was to be rationalized. These efforts to produce new nutritionally-minded households also folded into contemporaneous efforts by the colonial state to “improve” the natural spaces of Mauritius by eradicating malaria: forests were cleared, rivers canalized, and pesticides spread. Mauritius was, one study declared, “a sanatorium.” This paper examines the social aftershocks of these efforts to intervene in the biological and natural worlds that Mauritians inhabited. Debates over food and disease proved to be fertile territory for emerging discourses of political community, constitutional change, and diasporic belonging. Drawing on the colonial archive, the papers of Indo-Mauritian cultural organizations, newspapers, and the writings of Hindu intellectuals, this paper suggests that the emergence of political community and civilizational thought drew from, in part, gendered debates over how Mauritians encountered the natural world as well as their nutritional habits. It centers the historical significance of Indian Ocean networks of knowledge and culture in Mauritius while also attending to the locally specific ways in which those networks became meaningful for Mauritians.

The Description of Plant ‘Metabolism’ in Albert the Great’s De Vegetabilibus: The Case of Flowers and Fruits

Marilena Panarelli
Università del Salento

Albert the Great’s De vegetabilibus represents the first complete treatise on the vegetal world in the medieval Latin West. Albert focuses on plant physiology, especially dealing with digestion, as he adapts the doctrine of human digestion to plants by describing every activity in them as due to a precise phase of digestion. Albert’s description of plants relies on digestion and nourishment as the body undergoes a continuous state of dissolution and growth. In his text, Albert provides a detailed overview of every type of moisture and heat that operate within digestion. In this way, he explains the diverse phases of vegetal life, blooming and ripening. Accordingly, the generation of flowers is the first ebullition of the subtler part of moisture from which, therefore, derives the
generation of fruits. As a result, Albert presents an innovative interpretation of life. In my talk, while analysing Albert’s description of the generation of flowers and fruits and of the diversity of their accidents, like colours, forms, flavours and smells, I show that the generation of each part of a plant is conceived as a stage of the whole metabolic process. By assigning a complex metabolic process to plants in order to describe each of their activities, Albert’s innovative approach represents an important moment in the history of botany.

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The Discovery of RNA Splicing as a Surprise: Stability of the DNA-Protein Co-Linearity Theory or Faulty Foundations of Biological Diversity?

Pnina Abir-Am  
Brandeis, US

The discovery of RNA splicing in 1977 is widely considered to be a turning point in molecular biology, often viewed as the starting point of the RNA revolution. By showing that many eukaryotic messenger-RNAs are not co-linear with DNA but rather are the products of multiple splicings of non-contiguous segments of a primary transcript of the genome, the discovery led to a new paradigm of genetic regulation. The theory of co-linearity, established in the early 1960s, became so entrenched by the mid- and late-1970s that it prevented the most advanced labs from interpreting accumulating evidence in favor of "splicing." The talk examines whether the stability of the co-linear theory or paradigm was accompanied by faulty foundations such as the assumption that eukaryotes are no different in their life mechanisms than prokaryotes. If so, why some labs (e.g. J. Darnell’s at Rockefeller University) could not give up the belief in the strong co-linear theory, thus missing a discovery that of RNA "splicing", or a discovery that is viewed as the third most important one in molecular biology? (i.e. after DNA structure and m-RNA function) while others (e.g. Cold Spring Harbor and MIT) labs were able to abandon the co-linearity theory, perhaps because they were more aware of the faulty foundations of a world view with limited possibility for genomic diversity. The talk further compares and contrasts the leading contender labs in terms of their affinity to stable theories, faulty foundations, new experimental opportunities, social composition, and mentorship by leading scientists.


Jules Skotnes-Brown  
University of Cambridge

Between the 1890s-1930s, South African fauna was under significant threat. The last wild spaces were being appropriated by agriculturalists, and their animal inhabitants shot in the thousands. Veterinarians, convinced that wildlife and civilisation could not coexist, had indicted wild animals as reservoirs of disease, and commercial nuisances. Economic ornithology, a US-born discipline which quantified the value (or harm) of birds to agriculture, posed a powerful counter-argument, and found strong-footing in South Africa. Numerous publications argued the economic and medical utility of birds, mammals, and reptiles in consuming anthrax-infested carcasses, plague-bearing rats, nagana-spreading tsetse-flies, and crop-devouring locusts. In the emerging intellectual environment of holism, naturalists Frederick FitzSimons and Alwin Haagner argued that not only birds, but all wildlife had productive value. Nature, contra-veterinary opinion, was hospitable, and humans were responsible for epidemics and crop-failure by upsetting its balance. Farmers needed to capitalise upon the agency of insectivorous birds by planting trees and building nesting boxes. Poultry needed to be trained to “police” insect and rodent thieves. Ultimately farmers were uninterested in these measures: they were already practicing a local ‘economic ornithology’ by destroying pests and accommodating ‘useful’ birds. The diminutive historiography of economic ornithology has depicted it as a short-lived science, supplanted by pesticides. I argue, on the contrary, that despite its failings in practice, it was influential in 1920s-1930s scientific and conservationist thought.
Imbued with economic and medical utility, living fauna could no longer simply be blamed for disease, subsequently veterinarians began targeting insects and microorganisms rather than animal hosts.

The Extirpation of Idolatry and the Secularization of Nature: Jesuit Missionaries and Indigenous Healing Knowledge in Colonial Peru

Matthew Crawford
Kent State University

In colonial Spanish America, missionaries served as important collectors and mediators of indigenous knowledge of the natural world. Missionaries, especially Jesuit missionaries, provided some of the earliest accounts of American nature. Much of this knowledge came from their contacts in indigenous communities and, as a result, missionaries played a vital role in the assimilation of indigenous knowledge to European ways of understanding the natural world. Focusing on missionary accounts of indigenous knowledge of medicinal plants, this paper will explore the role of Jesuit missionaries in the secularization of indigenous knowledge—a process whereby missionaries stripped away any spiritual meaning that local nature had according to indigenous worldviews and religions. Instead, many missionaries reported and encouraged others to report only the pragmatic use and empirical information about natural phenomena. What is interesting is that the Jesuits and other missionaries had religious motivations for engaging in the secularization of indigenous knowledge of nature, especially in seventeenth-century Peru during the campaigns to extirpate “idolatry” among native Andeans. Consequently, this paper seeks to highlight the role that Jesuit missionaries played in making New World nature knowable to European sciences, while also emphasizing their underappreciated role in the secularization of indigenous knowledge—a process that has echoes in the persistent tendency to characterize indigenous informants as purveyors of empirical observations.

The Failure of a Japanese Mad-Scientist? Sakaki Yasusaburō and the Steinach Rejuvenation Operation in the 1920s

Yize Hu
Johns Hopkins University

Inspired by the ability of hormones to regulate metabolism, some medical researchers tried to realize the dream of human “rejuvenation” in the early 20th century. In 1920, Eugen Steinach (1861-1944) claimed to have found a scientific way to rejuvenate human bodies in a procedure he dubbed “the Steinach Operation.” Although highly controversial, the operation continued to be performed in Europe and America in the 1920s and 30s. However, its reception in Japan was different. When first introduced to Japan in 1921 by Sakaki Yasusaburō, it was immediately attacked by critics. It almost totally faded from the public eye after 1925 when Sakaki was ostracized by the academic medical community. Why did the rejuvenation method fail so quickly in Japan? Is it because this method was quackery or “pseudo-science,” or because rejuvenation was not attractive to Japanese people at all? This paper argues that the failure of the Steinach operation resulted directly from Sakaki’s defeat in the factional struggle within the medical community, while the operation’s scientific unfeasibility played a secondary role. The failure was further consolidated by the fact that the operation was not supported by or merged with other rejuvenation methods belonging to the non-Western yōjō/yangsheng tradition. This case study shows how the medical community in Japan in the 1920s evaluated the “effectiveness” of a new technology from the West and how this evaluation was strongly shaped by the power structure of the professional community. It also explores the interaction between Western and non-Western medical traditions.

The First Treatise of Indology and the Origins of Anthropology

Carolina Armenteros
University of Cambridge
It is rare to find scholarly classics whose authors were not eager to be acknowledged, but such is the case of Moeurs et coutumes des Indiens (1777), a founding treatise of Indology and a classic of early anthropology whose real author remained obscured for two centuries. That the mystery endured so long is in part due to the fact that Moeurs et coutumes was published twice in the half-century following its composition, under two different names. But the reason its true author, the Jesuit Father Gaston-Laurent Coeurdoux (1691-1779) wanted to remain anonymous was the state of shame and ignominy in which the former members of the Society of Jesus found themselves after Clement XIV dissolved the Society in 1773.

This paper presents Indology’s first treatise for the first time to an English-speaking audience with a dual purpose: to describe its content and descriptive method in the context of contemporary travel and proto-ethnographic productions, particularly those of non-Jesuit missionary orders; and to assess its influence upon, and similarities to and differences from, the disciplines of ethnology, anthropology and Indology as they came to maturity in the nineteenth century. The main aim is to gain consciousness of how the ethnological sciences were molded—or not—by missionary methods and circumstances of the Age of Enlightenment, and how awareness of these facts can help us to develop more faithful ways of perceiving anthropological realities.

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The Function and Value of Animal Ethics Committees in Australia: Historical Perspectives and Current Practices

Karina Burns
University of Adelaide

This paper considers how the current system of animal research regulation in Australia emerged within the cultural and political climate over the last four decades. This inquiry uses the development of the Australian code of practice for the care and use of animals for scientific purposes (the Code) as a framework for understanding changes in standards for animal research practices. This analysis traces the development of themes across the eight editions of the Code. Changes in the way important conceptual terms such as ‘animal,’ ‘pain,’ and ‘ethics’ are defined across the eight editions are used to analyze changes in attitudes and understandings. The Australian system of self-regulated Animal Ethics Committees is compared to the systems in place in the US, Canada, and the UK. This comparison explores the origins of Australia’s legislative framework, highlighting both disparate and parallel systems to determine the details of international influences on early policy making in Australia. Drawing on the voices of those directly involved, the regulatory system for animal research in Australia is critically evaluated to highlight the strengths and weaknesses that exist in the historic and current systems.

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The Historical Evolution of Allostery: From a Population-Based Account to a Single-Molecule Account and Back Again

Jacob Neal
University of Pittsburgh, History & Philosophy of Science Dept.

Allostery describes the process whereby ligand binding at one site on a protein transmits an effect to another distal site. Ever since its discovery in 1961, allostery has remained an important topic within structural biology because of its role in cell regulation. However, the concept has changed drastically since Jacques Monod and his colleagues first characterized it. This paper aims to recount the conceptual evolution of allostery over the past 50 years. I argue that the concept has evolved in three stages. First, from the late 1950s to the mid-1960s, allostery was a population-level phenomenon, closely tied to biochemistry and heterodox enzyme kinetics. Then, starting in the mid-1960s and extending to the mid-2000s, allostery became a feature of individual protein molecules with special structural and conformational properties. The final stage in this conceptual evolution, which introduced the ‘ensemble nature of allostery’, began in the mid-2000s (Motlagh et al. 2014). Creager and Gaudilliere (1996) have offered
an explanation for the first historical transition based on the complex interplay between theory and experiment, and it is the primary aim of this paper to characterize the second transition and offer an explanation for it. I aim to show that the driving forces behind the conceptual shift from the structural-mechanistic view to the ensemble view were twofold: (1) the mounting body of anomalies that could not be explained by any of the structural-mechanistic models of allostery and (2) the increasing recognition that protein dynamics play an important role in protein structure and function.

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**The History of Chemistry and/as the German Question**

Michael Gordin  
*Princeton University*

The difficulty of integrating the history of chemistry into general narratives in the history of science recalls a historical (and historiographical) problem of how to deal with “Germany” within the general arc of European history. At most points of European history, defining where precisely “Germany” lay was a contested issue, but it has been even trickier to locate “the Germans.” The superficial solution is typically to focus attention on historical populations who lived on territory that today falls within the boundaries of the present-day Federal Republic, which excludes not only Austrians and Swiss Germans, but Bohemians, Transylvanians, Volga Germans, Pennsylvania Dutch, and more. This taxonomic dilemma presents an analogy with the history of chemistry: the boundaries of the discipline and who might count as a “chemist” over the centuries is notoriously difficult to pin down. Beyond drawing the comparison, this talk suggests that the two historiographical puzzles are historically related. The location of “Germany” as a site for alchemy, chemical industry, and chemical warfare consistently troubles the incorporation of the field into the general history of science, and into narratives of European history more broadly.

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**The History of Science and the Many Worlds of Nikolai Vavilov**

Elena Aronova  
*University of California, Santa Barbara*

The Second International Congress of the History of Science, held in London in 1931, is chiefly remembered for the surprise appearance of the Soviet delegation and the lasting imprint that Boris Hessen’s Marxist reading of Newton’s Principia has left on the history of social constructivist thought in science studies and the history of science. This paper will revisit the story of the Congress, taking the history of this event out of the disciplinary historiography of the history of science and considering the preoccupations of its participants with the unity of knowledge articulated by international scholars in Europe, the US, and post-revolutionary Russia, driven by a spectrum of political and epistemic commitments. The paper will focus, in particular, on the least noticed member of the Soviet delegation, Nikolai Vavilov, whose work, in the view of the Congress’ participants, has bridged the gaping divides between written history and that of the unscripted era, between human history and geohistory, and between the historians and the scientists. Paradoxically, the collective memories of the Congress as the turning point in historiography of science, as well as those of Nikolai Vavilov as a martyr of genetics and the founder of biodiversity research, have reproduced the very disciplinary divisions that many Congress’s organizers and participants sought to dissolve.

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**The Interplay’s the Thing: Interrogating the Intersections of Theater and Modern Science**

Ashley Clark  
*University of Chicago*

Theater and science have been, and continue to be, entangled. It is telling, for example, that the most produced playwright in the USA during the 2017-2018 season was Lauren Gunderson, who specializes in plays based on narratives from the history of science. We, as historians, also engage with the entanglement of theater and science when we employ
the titillating metaphors of historical “actors” who “perform” the experiments in our own stories of science. But the nature of our job requires us to engage with heightened awareness, probing the nodes of intersection of theater and science while testing the variety of ways we can access and interrogate those intersections. The papers in this panel offer a range of historical examples that highlight the role theater can play in science, and vice versa. Each paper covers a specific moment (between the 1790s and 1930s) when the stage served as a testing ground for scientific innovation or experimentation. Brought together, these histories exemplify the significance of “play” in experimentation and introduce new sites of exchange between scientific thinking and the creative process. The staging of these experiments unites the social, aesthetic, and scientific realms, inviting historians of science to interrogate the metaphors of “performance” in the history of science. Ultimately, this panel aims to catalyze discussion about the profound ways in which theater—both written and produced—has contributed to our stories of science.

The King’s Business: Transacting Transmutation in Medieval and Tudor England

Jennifer Rampling
Princeton University

When medieval and early modern England was threatened by currency crisis, the possibility of transmutation became a matter of state. From the fourteenth century, English monarchs and their ministers cracked down on counterfeiting while simultaneously turning to alchemists to help resolve bullion shortages and restore confidence in English coin. A paradox ensued. On the one hand, transmutation—if attainable—offered a solution to England’s currency woes. On the other, false “multiplication” of metal threatened to debase the coinage further. This tension was reflected not only in official responses to alchemy, but in the language adopted by alchemists themselves, who sought to distinguish alchemically-produced gold from the debased metal confected not only by multipliers, but also, increasingly, by the English mint. In this paper, I trace some of the consequence of English courtly interest in alchemy, particularly during a relatively understudied period: the reign of Henry VIII. At this time, transmutation was technically illegal in England. Yet, contrary to what we might expect, claims of alchemical expertise did not always land practitioners in trouble—on the contrary, they could offer a lifeline for alchemists being investigated for other crimes. During the 1530s and 40s, men like William Blomfield and Richard Jones emphasized their alchemical skill in petitions to kings and royal councillors, hoping to ameliorate charges of fraud, conjuring, and even treason. I shall argue that such offers resonated among mint officials and royal councillors who sought both to increase private wealth and to stabilize the currency.

The Linguistic Questionnaire and the Formation of General Linguistics Between the Sciences and the Humanities

Emma Mojet
University of Amsterdam

General linguistics is notoriously difficult to position in either the humanities, social sciences, or natural sciences departments. This is mirrored in historical debates, which were especially prominent between 1880 and 1930, when linguists were discussing methodological issues in order to define their discipline. The linguists turned to the natural sciences to justify their academic discipline and ties with humanities and social sciences were also present. This paper focuses on a research method through which I aim to show these ties: the linguistic questionnaire. Using the questionnaire, linguists such as Jules Gilliéron (1854-1926) argued they could do research with scientific, observational rigour; methodical, with comparable results and systematic notation. The results of the linguistic questionnaires were presented as maps, with Gilliéron’s Atlas linguistique de la France (1902-1910) as a famous example. While the linguistic questionnaires were primarily aimed at collecting different dialects in a systematic way, the research tool developed into a
method to also collect social factors which could have an effect on the subject’s spoken language. This change of focus can be pinpointed as a direct influence on general linguistics from the new discipline of sociology, which the collaboration between linguist Antoine Meillet (1866-1936) and sociologist Émile Durkheim (1858-1917) illustrates. Through the case of the linguistic questionnaire, I aim to show how general linguistics evolved as a discipline between the humanities, the natural and the social sciences.

The Logic Behind the Logic Theory Machine: Administrative Science, RAND, and the Dawn of Artificial Intelligence

Jonnie Penn
University of Cambridge

The Logic Theory Machine (LT) has been described as “The First Artificial Intelligence Program” (Crevier, 1993). LT was a proto-computer-program developed at the RAND Corporation in Santa Monica, California in 1955-56. It was designed by Herbert Simon, Allan Newell, and J. Clifford Shaw (hereafter “NSS”) to discover and construct proofs from Principia Mathematica. The RAND trio’s goal was to model human problem solving using an electronic computer, which they claimed to have accomplished with LT’s first successful operation in 1956. The purpose of this paper is to isolate the specific competencies used by NSS to justify comparisons between LT’s abilities and those of a human being. This step serves to introduce the particular ways in which human nature had to be framed in order to match up neatly, by analogy, to the competencies of LT.

The structure of my paper is as follows. To begin, I introduce how Herbert Simon’s training in logical positivism under Rudolf Carnap at the University of Chicago in the 1930-40s shaped his view of the social sciences and, in turn, the design specifications of LT in the 1950s. In 1947, Simon published Administrative Behavior, an influential text designed to turn administration into a science using formalized linguistic and conceptual tools. I show how in 1955, NSS then translated these tools into a new medium—electronic computing—to formalize the adaptability of the human brain. The product, LT, served to formalize and legitimize the field of artificial intelligence.

The Mercurial Gaze: Distinctly Trainable Students, Measurement, and Mental Deficiency at the Elwyn Training School, 1940-1960

Leah Samples
University of Pennsylvania

On Tuesday, November 27, 1945, Mrs. Constance Rhodes received a personal letter from Dr. Arthur Whitney, superintendent of the Elwyn Training School for Mental Defectives in Media, Pennsylvania, letting her know that her seven-year-old son, Roger, “can not be granted admission to Elwyn because we accept only the distinctly trainable children, with IQ’s above 50.” Whitney added any child with an “IQ of 50 at the age of seven will probably have an IQ of 30 at the age of fourteen.” Roger’s rejection by the Elwyn School demonstrates both the malleability and authority of measurement testing in postwar America for the identification of mental deficiency. I suggest that Dr. Whitney attempted to stabilize the diagnostic boundaries of mental deficiency through the establishment of new admission policies based on measurement testing. The administrators at Elwyn, however, grossly overestimated the stability of the IQ test as a measurement tool upon which the classification and diagnosis of mental abnormality rested. This presentation engages with the history of medicine and disability scholarship to show that, yes, diagnoses and designations can be, have been, and are oppressive but that upon closer examination these constructions are simultaneously unstable, permeable, and full of gaps. If we shift to focus on the enterable qualities of these designations at the Elwyn School, we see that families and students were an essential, and operative, part of the production of mental deficiency.
The feminization of nature is a familiar story to historians of science. In The Death of Nature, for instance, Carolyn Merchant famously argued that nature’s presumed femininity acted first to restrain then to justify exploitative practices like mining in early modern Europe. Less well known are the tensions within this seemingly hegemonic discourse. This paper revisits the activities of travelers who, as women, were politically subjugated, and whose writings re-worked typically misogynistic tropes about the earth’s “womb” and “springs” to challenge prevailing views of nature and society. In Germany ca. 1800, views of nature and sexuality were rooted in cameralism, an administrative science that made all natural resources—including human and especially women’s bodies—subject to the revenue-raising enterprise of the state. Germans’ conception of the subterranean as a fertile cavity there to be penetrated and plundered was thus echoed in primers that taught “Germany’s Daughters” to emulate the “Utility and Fertility” of their natural counterparts. Some, however—like Julie von Bechtolsheim (1751-1847) and Bettina von Arnim (1785-1859)—saw in this domineering view of nature an “apt moral” (to borrow from Mary Shelley), and used the feminization of nature as the basis their social and environmental protest. Among other things, this talk will examine the relationship between Arnim’s and Bechtolsheim’s use of weaving as a metaphor for subterranean nature and their establishment of spinning mills for impoverished women, as well as the role of (literal and metaphorical) suicide in a political program grounded in the feminization of nature.
selection, neutralists look first for the effects of drift, migration, and mutations. This methodological divide expanded first to paleobiology and then community ecology, and later beyond biology to economics and linguistics. Biologists, historians, and philosophers of science understand this divide well in evolution, partially in paleobiology, and barely in community ecology. But they have not noticed it beyond biology, and have not appreciated that it has the general methodological divide it is. Anywhere scientists investigate abundance patterns and favor selection explanations, neutralists seem likely to appear. Why is this? In this talk I will show that epistemic, sociological, and historical factors are all responsible. Data for abundance patterns is poor for most natural systems, and it is difficult to establish that selection is operating. This gives rise alternatively to groups of scientists who double-down on finding selection and who ignore selection. These episodes are not independent, however. For example, Stephen Jay Gould migrated between evolution and paleobiology and Daniel Simberloff between community ecology and paleobiology, each carrying tools and methods along. Analyzing this divide with these factors will enrich our understanding of why biologists use the methodologies that they do.

The Non-Humboldtian Revolution in Botany

Gabriel Finkelstein
University of Colorado Denver

In 1861 the botanist Joseph Dalton Hooker published a devastating review of an expedition undertaken by his German rivals, the Brothers Schlagintweit, to India and Central Asia. “There is ... a suspicion abroad,” Dalton informed readers of the Athenaeum, “that the brothers’ appointment was one of the most gigantic jobs that ever disgraced the annals of science.” A variety of impulses drove Dalton’s criticism: personal jealousy, national rivalry, professional integrity, and the one that most historians identify, the decline of Humboldtian methods under the onslaught of Darwinian theory. My talk will propose an additional interpretation of this controversy, namely that Alexander von Humboldt’s lavish maps of vegetation never enjoyed quite the influence among botanists that their beauty might suggest. Much like Vesalius’s De Fabrica three centuries earlier, Humboldt’s images of the geographical distribution of plants at high altitude remained more of a monument to scientific illustration than a tool of working scientists.

The Organismal Landscape in Developmental Biology

Nathan Crowe
University of North Carolina Wilmington

Using data from the General Embryological Information Service, we describe and analyze global trends in organism use during the 1950s and 1960s, visualized with topographic landscape diagrams. While the overall trend for developmental biology has been toward greater use of mammalian and avian systems, our visualization tools allow us to focus our analysis on specific research areas, such as fertilization or regeneration, where local trends show strong entrenchment of non-mammalian organisms. Juxtaposing these kinds of cases to the broader move toward mammalian systems, we suggest that the broader trend can be explained by a desire to make specific research problems more directly relevant to human biomedicine, while limited access to the phenomena in question played a key role in organismal entrenchment in specific research areas. Using organismal landscapes generated from the GEIS creates new opportunities to analyze the contingent factors that drive continuity and change in a biologist’s choice of research organism.

The Origins of Modern Climatology in Wladimir Köppen’s 1901 Climate Classification and Map

Mott Greene
University of Washington

Periodization in the history of science is governed by the appearance of certain texts: Newton (1687), Lavoisier (1789), Lyell (1833), Darwin (1859), Einstein (1905), Watson and Crick (1953). Knowing
the names and dates, we can call off the titles of these works, all seen to initiate a new phase in the life of a given science. These foundational classics are seen to be built upon, but not overthrown. In climatology, such a foundational work is Köppen (1901): Versuch einer Klassification der Klimate, by Wladimir Köppen (1846-1940). This text and its accompanying map defined what we mean by climate today—suites of animals and plants living at different latitudes, in regions whose character is defined by mean temperature and precipitation. The system of climate zonation Köppen presented in 1901, and his scheme for mapping it, is still in use everywhere. Temperature and precipitation provide the threshold boundaries for suites of animals and plants that we now call indicator species; the shift in thermal and precipitation regimes at given latitudes, and the changing animal and plant communities at these same latitudes, constitutes what we mean by "climate change." The “Köppen zones” and their associated species at the beginning of the 20th century function, to a very great extent, as the baseline climate for the modern world. Given scientific interest in climate change today, Köppen’s 1901 monograph has every right to be considered one of the most important scientific works of the last century.

The Reception of a New World Drug: 100 Years of Sassafras in English Print

Katrina Maydom
University of Cambridge

How was knowledge about exotic drugs presented, consumed and contested in early modern print? Groves of large sassafras trees grew naturally in abundance in the English North American colonies, and the roots, leaves and bark were harvested for their medicinal virtues in treating the Pox, scurvy and women’s infertility. I consult 179 texts published in England between 1580 and 1680 that discuss sassafras, including letterpress books, pamphlets, serials, newspapers and other ephemera. These texts include literary, medical, religious and political writings that allow us to investigate sassafras' reception as a cultural marker, economic commodity and medical drug. While physicians were the most common writers of works discussing sassafras, clergymen, poets, explorers and colonists were also engaged in sharing knowledge about sassafras. I find that sassafras was not regularly referred to immediately after its introduction, but rather after a concentrated effort to commercialise the drug seventy years after its first discussion in English print. After 1650, the frequency of discussions of sassafras and the diversity of diseases that it was recommended to treat increased significantly in scale. After sassafras was popularised, it was co-opted into contemporary debates, such as those between Galenic and chemical physicians, which had little to do with its status as originating from the New World.

The Religion and the Science of the Young Isaac Newton

Mordechai Feingold
California Institute of Technology

The nature and extent of Isaac Newton’s religiosity has become a dominant feature of Newtonian scholarship, ever since the opening of the Jerusalem archives. However, whereas Richard Westfall, for example, could acknowledge Newton’s piety, and recognize the earnestness with which he had pursued his theological studies without contending that they necessarily shaped Newton’s science, more recent scholars have insisted on ascribing a single source of inspiration to both domains. My paper will insist on the need to avoid considering Newton to have remained one and the same from birth to death, or that radical religious beliefs had been integral to his scientific activities from the start. Rather, I shall argue, Newton’s theological opinions evolved over time—and later than contemporary scholars assume.

The Rise (and Fall) of the Food-Drug Line: Classification, Gatekeepers, and Spatial Mediation in U.S. Food and Health Markets

Xaq Frohlich
Auburn University
This paper explores the history of the “food-drug line” in U.S. product regulation: the classification boundary developed by public health regulators and medical professionals to demarcate medical products, with stricter safety standards, from food and dietary products normally governed by more lax, informal marketing standards. The paper will describe the American Medical Association (AMA) and U.S. Food and Drug Administration’s (FDA) 100+-year history of using product classification to allot risk decision-making in consumer food and drug markets, linking these practices to regulators’ ideas about “gatekeeper theory,” the belief that access to risky products like drugs should be mediated by expert gatekeepers such as medical doctors. The paper will focus on the debates over food and drug labeling in the 1960s prompted by several new health food trends: vitamania and industry use of vitamin-enrichment, artificial sweeteners and low-cal foods, and the “cholesterol controversy” that fueled broad interest in low-fat foods and preventive medicine. Marketing campaigns in these health foods transgressed the classification barrier the FDA and AMA sought to build between food and drug, at a time when they were trying to develop clear guidelines on prescription drugs in the wake of the thalidomide scandal. The paper examines the food-drug line, its rise and fall over the course of the twentieth-century, as an example of institutional framing linked to and shaped by changes in the ways regulatory science addresses risk and responsibility, shifting retailing environments for health products, and the evolving relationship of a consuming public to medical and regulatory experts.

The Role of Chemical Analysis within the Indirect Amalgamation Process in the Habsburg Monarchy, 1784-1848

Peter Konečný

Max Planck Institute for the History of Science, Berlin / TU Munich

The indirect amalgamation technology, developed by Ignaz von Born following older methods from the Spanish colonies, was intended to be nothing less than a revolutionary method of extraction of precious metals using mercury. Between 1784 and 1786, the Austrian mineralogist and mining expert Born developed, together with his academic collaborators, a technological process that acknowledged the complex nature of gold and silver ores mined in the Habsburg Monarchy. As a metallurgic-chemical process, it not only considered the economic efficiency of the production, but led also to scientific disputes about the chemical composition of the treated ores. In 1786, these questions were discussed by an international gathering. After that, the amalgamation process was more or less successfully applied in Saxony, Norway, etc.

The lesser-known part about the indirect amalgamation technology is its practical application in the Habsburg monarchy after 1786. Originally put to trial in Hungarian mining districts (now in Slovakia), it was adopted throughout the Habsburg monarchy in almost all areas that produced precious metals. My paper will concentrate on the role of chemical analysis within the amalgamation sites—the various motives pursued by chemists and mining administrators, competing understandings of the technology’s merits, and how different local settings shaped whether or not the process was used for a long or short period of time. The crucial question of chemical composition was not only a scientific dispute about the affinities of different precious and non-ferrous metals, but was also the determining factor of technological functionality.

The Romance of the Bean: Rethinking the Soybean as Technology and Consumer Commodity in Early Republican China

Wendy Fu

Emory University

This paper examines the shifting semantic cadences of the soybean as global economic conditions re-shaped Chinese scientific and medical enthusiasm for the soybean. Older associations as a famine crop, base for fertilizer, a source for cooking, lubrication, and lighting joined newer, techno-scientific visions of the soybean as a global industrial commodity and modern
foodstuff. Intensified imperialist competition between Japan and Russia transformed the agricultural and industrial landscape of northeastern China, and one byproduct of this competition was the transformation of the soybean into a global cash crop whose economic value lay well beyond its agricultural origins. The soybean, in this globalized context, captivated the attention of late Qing, early Republican intellectuals, because it portended a brave, new world driven by technological innovation, yet still organically tied to a notion of Chineseness. The Chinese anarchist Li Shizeng especially sought to enlighten his fellow countrymen about the soybean’s technological potential to revitalize and transform Chinese industry in a manner that also embraced its agricultural and culinary heritage. His efforts to raise the soybean’s profile by extolling its many industrial and gastronomic uses articulated a Chinese path of modernization and gestured to a more intimate reappraisal of the meaning of food for an aspiring nation.

The Science behind Sanguine: Chronobiological Concerns with ELF

Jole Shackelford
University of Minnesota

Project Sanguine was a controversial program to develop a network of power stations, amplifiers, and 6000-miles of antenna cable to serve as a communication transmitter capable of sending signals to submerged submarines around the globe. Publically proposed in 1968, northern Wisconsin was chosen as a suitable site, with full operational deployment of Sanguine expected in 1975. The project generated a great controversy in the state and was met with vigorous opposition in Madison, where the state capital and the University of Wisconsin were located. Navy tests in the 1960s had aimed to determine if service personnel who worked in close proximity to the hardware were exposed to undue risk, mainly from electrical shock, with no attention to possible effects of the electromagnetic fields on the general public or to the biotic environment otherwise. Why was it, then, that the Office of Naval Research in 1971 charged the American Institute of Biological Sciences to appoint a committee of biologists to investigate possible hazards? This presentation will offer explanations to this question in the context of the biological rhythms research in the 1950s and 1960s and the theoretical explanation for why even very weak ELF fields might present biological dangers to both vertebrates and invertebrates, when much stronger intensities at higher frequencies were shown to be harmless.

The Science of Ideology Critique: Fredric Jameson and Architecture Theory in America

Matthew Allen
Harvard University

In the period following WWII, ideology critique was often characterized as a science. The French philosopher Louis Althusser epitomized this stance, updating Marx’s theories to analyze the growing tertiary economy in Europe. In social theory, literary criticism, and philosophy, "historical materialism" positioned itself as a science in competition with the "positivist" science of other disciplines. This Marxist science was imported into American academic architecture in the 1970s, and it became the mainstream of architecture theory in the 1990s. This paper examines what characterized ideology critique in Europe and how it was transformed in its trans-Atlantic journey.

I will focus, first, on the IUAV and analyze how this higher education institution in Venice developed a "scientific" research program that generated and accumulated knowledge. A leading figure at the IUAV, Manfredo Tafuri, developed a mode of writing to describe the contradictions that provided, in his view, the motive force of architectural history.

I will turn, second, to one of Tafuri’s American interpreters, the literary theorist Fredric Jameson. Jameson retained Tafuri’s dialectical mode of writing but abandoned the IUAV’s research program. I will describe the features of Jameson’s writing that made it
"scientific," including his reliance on para-textual diagrams and formulae, and how ideology critique disseminated through a unique discourse network of conferences, publications, and teaching.

Today, as many figures in architecture theory are aligned against "instrumentality" and science generally, it may be useful to remember their predecessors, who had a less monolithic view of science—and saw themselves as scientists.

The Science of Value: Economic Expertise and the Pricing of Human Life in Federal Regulatory Agencies

Katherine Hood
UC Berkeley

This paper explores efforts to apply economic logic to human life. In U.S. federal regulatory agencies, government planners and policy makers have spent over a century trying to devise a scientifically sound way to measure the economic value of lives lost or saved by public programs. The methods they have drawn on, however, have changed drastically in the past 40 years, shifting from a ‘human capital’ approach based on models of economic productivity and producing relatively low dollar values to a ‘willingness-to-pay’ approach reflecting consumer choice and producing much higher values. Why, in an era of intense deregulatory pressures, did the valuation model that produced significantly higher estimates—making it easier to justify costly regulation—ultimately win out? This unlikely transition follows a shift in the nature of professional expertise dominating the federal bureaucracy during the 1970s and 1980s, as changing conceptions of health and safety regulation during this period gave academic economists the opportunity to make new claims about the exclusive authority of microeconomic theory for understanding the economic value of life in federal planning. Supporting this argument is a comparative case, the largely unsuccessful attempt to extend the willingness-to-pay model to the valuation of life in the courtroom. Pricing human life thus results not only from the renegotiation of moral boundaries around the economic logic of the market, but also from the reorganization of expert authority and the consolidation of scientific expertise around both the meaning and the measurement of value.

The T Suppressor Cell Program and the Dynamics of Collective Error in Biomedical Science

Thomas Kepler
Boston University School of Medicine

Science is regarded by many as unique among human endeavors in its inherent ability to correct its own errors. Many cases, such as those involving N-rays or cold fusion, are offered to exemplify the process. These episodes are uncontroversial and make attractive illustrations, but there are less well known cases in which acknowledgement of error is universal, but there is no agreement on just what exactly was mistaken. These cases are certainly more complex, but likely more informative as well.

I will introduce the Suppressor T-cell program, which spanned the 1970 and ‘80s, and present my analysis of its rise, fall, and lasting influence. Broadly: In the wake of recent stimulating progress, highly anticipated experiments were performed and their striking results compellingly interpreted in terms of the new theories. The nascent field that quickly arose attracted hundreds of investigators and the enthusiastic financial support of the NIH. But over time, new experiments more often introduced complications rather than resolve outstanding questions. Key predictions failed. Eventually, the community lost its bearings and “T suppressor” became a stigma. Soon thereafter, however, a distinct program involving different investigators observed related phenomena and explained them via similar theories. The elements of these latter theories are now universally accepted and are actively studied.

There is no agreement about which observations were erroneous, or what, in modern terms could explain the phenomena. What transpired does not exemplify error correction; we have yet to understand how so many scientists were misled for such a long time.
When collagen, abundantly available in all the connective tissues of animals, humans included, emerged as an important research problem right after the discovery of the double helix, G.N Ramachandran (GNR), a young Indian scientist at the University of Madras, took up this topic as his main research problem. Working from the peripheral location of the Madras University in the newly-independent India during the 1950s, Ramachandran really had very little of hopes making an actual discovery, for already numerous elite research groups, such as Caltech or the University of Cambridge, had flung themselves in the game. And yet, in the end, Ramachandran finally cracked the structure of collagen, thus producing what has sometimes been called the Madras triple helix model.

Trained in his early career by CV Raman, and thereafter at the University of Cambridge under Lawrence Bragg, GNR returned to India during 1950s to pursue new lines of research. The small Indian scientific community, whose roots had been established during the colonial times, needed fresh discoveries and achievements so as to establish themselves in the scientific game. The discovery of the triple helix structure of collagen by GNR allowed him to bring a new lease of life to this small scientific community as well as to establish a trading zone with the Western scientific community. In exploring the fine structure of the trading zone that GNR built via his collagen model we see how newcomers in science can often function as important sources for new ideas and new insights.

There is a "folk history" of quantum physics within the community of physicists, one that bears little resemblance to the history of the field. According to this folk history, there is a single orthodox "Copenhagen interpretation" which solves or dissolves all of the questions at the foundations of quantum mechanics. This interpretation has been in existence since the Bohr-Einstein debates of 1927, if not before. Moreover, the folk history goes on to claim that Bohr successfully dismissed Einstein’s challenges at every turn, and the discovery of Bell’s theorem three decades later only solidified Bohr’s triumph. This folk history falls apart upon even cursory examination: there is no single coherent position known as the Copenhagen interpretation, nor has there ever been one. And none of the positions that go by the name “Copenhagen interpretation” do a good job of solving the measurement problem, the central interpretive problem at the heart of quantum foundations. Nor do they evade the nonlocality that is dictated by Bell’s theorem–nonlocality that was first pointed out by Einstein, and that was ignored by Bohr’s followers. Yet this folk history is still common knowledge among physicists, likely because it serves an important psychological function: it allows physicists to ignore the troubled foundations of quantum mechanics so they can get on with using the (phenomenally powerful) theory. In this talk, I will examine the origins of the folk history, the documentary evidence that belies it, and some of the effects of the folk history’s persistence within the field.
had plagued QED’s calculations in the 1930s and 1940s. Already in the late 1940s, the renormalization program found important allies, such as Wolfgang Pauli, Léon Rosenfeld, and Freeman Dyson. A new generation was educated in the United States in the early 1950s learning that QED was no longer a problem, and that they should then approach the other fundamental interactions, namely, the gravitational and nuclear ones. Following this narrative, several historians of science—Silvan Schweber, Jagdish Mehra, Alexander Rueger, among others—claimed that 1947 was a watershed in the history of QED, when the old problems were finally solved. In this talk, I discuss whether that narrative is adequate. I analyze some discontents of the renormalization program, namely, Rudolf Haag, Fritz Bopp, Irving Segal, and Arthur Wightman. They believed that the renormalization methods had questionable foundations and were, to some of them, plain nonsense. I also discuss Gunnar Källén’s position, who was a supporter of the renormalization program and, nevertheless, an opponent of Schwinger’s methods. I claim that QED was far from being considered a solved problem outside a limited circle of physicists in the 1950s, and that the standard narrative aligned perhaps too much with Schwinger’s and Feynman’s own perspectives.

English mathematician George Boole (1815-1864) is considered a principal inventor of mathematical logic and a major predecessor of computer science. Historians typically emphasize his recasting Aristotelian logic in algebraic notation and applying the computational techniques of mathematical analysis to the laws governing deduction. By emphasizing Boole’s place on the trajectory from ancient to modern logic, however, such a narrative reduces his project to its novel theoretical claims and obscures its practical, moral stakes. In practice, implementing his system meant translating life’s concepts into algebraic symbols. The fragmentary pedagogical materials preserved in Boole’s personal archive exhibit a system oriented toward concrete matters of moral and theological concern. Boole entwined exposition with a parade of practical applications, analyzing such constructs as God’s chief end in creation and the Jewish legal definition of clean beasts. Though he insisted his appropriation of mathematical symbols was not theoretically necessary, this choice allowed him to harness the existing computational expertise of numerate readers. Faced with the often complex definitions of the objects populating heaven and earth, mathematical logic provided a new way to write them down, a symbolic language that a properly trained reader already knew how to manipulate. Boole’s efforts toward a textbook display a conviction that readers would find theological applications an especially interesting and intelligible manifestation of his logic. The assumptions underlying his notions of practicality and accessibility reveal an epistemic context in which logic constituted an arena for working out the still unsettled relationship between theological tradition and modern mathematical science.
seemingly random layout and distribution of plants, this paper argues for a comparative reading of these books as a corpus of early modern natural philosophy.

In 1714, the Irish physician and respected member of the Dublin Philosophical Society, Thomas Molyneux published an intriguing account of fossil teeth found in Ireland in the Philosophical Transactions of the Royal Society. It argued that these specimens were the remains of prehistoric elephants and dismissed the popular belief that they belonged to extraordinarily large humans. Although Molyneux’s paper embraced the Royal Society’s emphasis on direct observation and empirical evidence, it was largely ignored by its contemporary audience. Fourteen years later, in 1728, the eminent naturalist and President of the Royal Society, Hans Sloane, published a similar piece in the Philosophical Transactions. It employed the same arguments and evidence as Molyneux’s work but was warmly received and widely cited. This paper discusses the different reactions to Molyneux and Sloane’s articles. It considers why the latter was more effective at undermining belief in the existence of giants tens- and hundreds-of-feet-tall and attributing the fossil teeth to elephants. It examines these works in the specific context of the scientific journal and explores the interaction between serial publications, personal natural history collections and institutional reputation in the early eighteenth century. A close analysis of the style and content of Molyneux and Sloane’s articles teases out subtle differences in their presentation. It grants insights on the link between scholarly reserve, ownership of specimens and academic credibility in pieces published in the Philosophical Transactions.

Timing Knowledge

Anna-Maria Meister

Max Planck Institute for the History of Science, Berlin; TU Munich (starting postdoc in September)

When is the right time to know something? What difficulties arise if knowledge is created prematurely or tardily? How do fears about the punctuality of knowing shape the tools applied to knowledge problems? And how is the historian’s understanding of the past configured by her concepts of time?

This panel investigates how the practice of scholarly and investigative programs is linked to distinct understandings of and anxieties about time in different contexts. It will consider not only how the temporal modes of those who conceive projects inform goals and planning, but also how the portrayal of those projects is determined by the temporal assumptions of observers: the pressure to deliver results on the clock and results that will last; the distinct temporal orientations of the cathedral builder, the industrial time-manager, the historicist legal-scholar; the many granularities of time in diverse fora at home and abroad. It will examine how time-scales and timing-schemes figure in disciplines like historiography (past and present), to architecture, economics, biology, and philology. Projects meant to be “timeless” will be examined alongside historiographical questions about “availability”: which versions of the past are accessible from which vantages, and what sort of ruptures make new world-views possible?

“Timing Knowledge” takes time both as an historical object and a point of methodological reflection. By assessing the restless tension between the timelessness and timeliness of knowing, between fluid contingencies and fixed truths, the panel attempts to move the conversation from “knowing what” and “knowing how” to “knowing when.”

To Avoid Hitting a Rabbit: Translating Theory into Practice in Death Valley National Monument, 1933-1941

Jonathan Shafer

Auburn University
Death Valley is the hottest, driest, lowest, place in North America. It is also home to thousands of desert-dwelling plants, animals, and paleontological artifacts. After the National Park Service took over management of the valley in 1933, park rangers struggled to develop a coherent strategy that would protect it and also allow tourists to visit there in comfort. This presentation traces rangers’ use of research on paleontology, wildlife biology, botany, and geology to accomplish their management goals on a proposed road through a small canyon with hundreds of well-preserved prehistoric footprints. It highlights how resource managers inconsistently translated research into practical policies and discusses how their decisions impacted plants, animals, and the landscape itself. It raises questions about hierarchies of knowledge and what constitutes science. It also invites discussion on how federal agencies engage subject matter specialists as they formulate public policy. The constellation of factors that ultimately led to the road project’s abandonment show how the agency interpreted scientific findings and used them to influence the physical shape of Death Valley.

To Sweat or Not to Sweat: Doctors, Deodorants, and the Female Body in the U.S.

Cari Casteel
Georgia State University

In a 1922 discussion of appropriate femininity, the author noted that “perspiration... steals away that natural freshness and fragrance” and “robs a young woman or girl of charm and daintiness.” Women navigated a complex system of etiquette in the early twentieth century in order to not only be perceived as beautiful, but also as feminine. Newly available deodorants and perspiration preventatives offered women a way to smell appropriately feminine, but like many new products there were a few concerns and questions. During the first half of the twentieth century deodorant consumers—predominately female—received mixed messages about the safety and efficacy of deodorants and antiperspirants. Many women worried about using a product that stopped the body from sweating. This paper discusses the origin and growth of the deodorant industry in the United States and how companies combined messages about appropriate femininity with medical knowledge—or the perception of medical knowledge to encourage consumers to purchase their product over a competitor’s. Deodorant makers warned their consumers that stopping perspiration was harmful. While the producers of perspiration preventatives hired medical doctors to assure their users that halting sweat was not just safe, but healthy. This battle for consumer loyalty did not just play out in advertisements, but also in the pages of medical and pharmaceutical journals as doctors and consumers debated whether or not it was safe to stop the body from perspiring and which products were the most effective at ensuring a woman’s “charm and daintiness.”

Towards a Bureaucratic History of Natural History: Genesis and Transit of the Cameralistic Static

Marco Tamborini
Institut für Philosophie, TU Darmstadt

Over the past decades, our comprehension of the structures of 18th-and 19th-century natural history has exponentially grown. Several seminal studies have been published on the quantitative practices initiated in these centuries, thus completely redrawing our image of natural history as a descriptive enterprise. Other works have called our attention to the materiality of natural history: lists, tables, papers, as well as cupboards not only enabled naturalists catalogue the world, but also influenced their perception of natural phenomena. Last, several historians have called our attention to the global dimension of natural history. Despite this positive trends, more needs to be done in order to obtain a comprehensive picture of both the transition from natural history to history of nature and biological “landscape” of the first decades of the twentieth century.

By expanding this ongoing research trend, my talk uncovers a particular approach to natural history.
This made a strong use of bureaucratic practices, data, and vocabulary in order to investigate natural history phenomena. By examining the introduction of the so-called cameralistic static in late 18th-century German science of administration and its circulation in agriculture and forestry through the 19th century, this paper aims at highlighting another important facet of 19th-century natural history: Its bureaucratic feature. I will investigate how bureaucratic knowledge shaped natural history investigations as well as which kind of bureaucratic practices were adopted in natural history. As a result, I will problematize the complex and bidirectional interaction between bureaucratic and natural sciences.

### Translation, Scientific Nomenclature, and a Language of Science in Colonial North India, c.1900–1930

Charu Singh  
University of Cambridge

My paper will focus on the career of the Hindi Scientific Glossary (1906), an artefact of nationalist knowledge making and the global circulation of western science from early-twentieth century South Asia. A bilingual lexicon containing Hindi equivalents for English scientific terms, the Glossary was created by the Nagari Pracharini Sabha of Benares (est. 1893) to facilitate the production of books, journals and articles to popularize science among Hindi readers who were unable to access scientific ideas in English. In the following decades, as Hindi intellectuals debated the appropriate strategy for standardizing scientific nomenclature, the Glossary became a point of reference and critique. Through the opinions of its makers, readers and critics, my paper will follow the Glossary from its inception in a literary society in the late-1890s to debates in the public sphere into the 1920s. I argue that the making of the Glossary was an event within the history of translingual scientific practices in British India. The translation of western scientific concepts through the production of lexical equivalents was integral to the cultural politics of language. Translation emerged as a positive strategy for assimilating western scientific knowledge for the enrichment of the Hindi language, especially at a time when Hindi intellectuals set out to raise Hindi to the status of a modern national language. I will conclude by reflecting on the political implications of Hindi’s failed quest for commensurability with English as a language of science in India’s postcolonial history.

### Traditional Ecological Knowledge in India–A Historical Assessment

Baisakhi Bandyopadhyay  
The Asiatic Society

Many traditional societies, often referred to as indigenous or tribal people, have accumulated a whole lot of empirical knowledge on the basis of their experience while dealing with Nature and natural resources. This traditional wisdom is based on the intrinsic realization that man and Nature form part of an indivisible whole, and therefore should live in partnership with each other. This eco-centric view of traditional societies is widely reflected in their attitudes towards plants, animals, rivers, and the earth. With biodiversity concerns having been pushed upfront, in more recent times, in the context of global change, traditional ecological knowledge (TEK), encompassing all issues linked to ecology and natural resources management has assumed greater significance. An assessment of TEK in India shows that it encompasses several fields, namely, sustainable forest management, biodiversity conservation by sacred groves, sacred landscape and sacred plant species, crop management, farm management, animal management and therapeutic role of Ayurveda. There is a rich trove of religious and nonreligious texts available in different centres in India that deal with these aspects of TEK. Of special interest is the complex relationship between indigenous ecological practices and other ways of interacting with the environment, particularly regional and national programs of natural resource management. TEK is important for its own sake and for its social and cultural values.
Transmutations of Light: Phosphors in the Early Eighteenth Century

Fokko Jan Dijksterhuis
University of Twente/Vrije Universiteit

In 1700 Johann Bernoulli (1667-1748) brought barometric light under control with his 'new phosphor'. It initiated a wave of inquiries that resulted, among other things, in the development of the first electrical engines. Bernoulli’s apparatus was just one instance of phosphor at that time. Light-bearers attracted wide interest of early modern inquirers: stones, animals, the new substance created from urine, the luminescence of vacuum, or the bright light of foci. These phosphors indicated new conceptions of light as a reactive substance that could be operated and employed to create material transformations. In this way, light became the heart of inquiries into matter and forces that bring together early Enlightenment developments in experimental philosophy. Modern disciplines tend to comminute the historiography of early modern natural philosophy. To overcome this, I approach the history of phosphors from the perspective of early-eighteenth-century protagonists like Bernoulli, Gottfried Wilhelm Leibniz (1646-1716), Wilhelm Homberg (1652-1715), Daniël Gabriel Fahrenheit (1686-1736).

Transnational Knowledge of Scientific Conceptions of Race and their Impact on Pictorial Representations of Homo sapiens in Mexico

Erica Torrens
National University of Mexico

For some years, the field of STS has focused on the need to write transnational connected narratives, based on a reciprocal treatment of global and local contexts that describe the dynamics of scientific practices to explain the role of transnational exchange networks and the circulation of scientific knowledge, people, artifacts and practices. This talk explores on the one hand, the genesis of scientific conceptions of race in Mexico and their accompanying impact on the racialization of bodies in eighteenth century and on the representation of Homo sapiens in nineteenth century. Both, the racialization of bodies and the reconstruction of human ancestry produced several visual representations which circulated in both a local and a global framework. This circulation of novel representational modes strongly influenced debates on race and national identity formation, especially during the nineteenth century when the term “mestizo” powerfully appeared in the political discourse as a symbol of identity in the formation of the Mexican Nation State and as a homogenizing center of national identity. On the other hand, I will talk about some representational practices related to the reconstruction of human ancestry in Mexican popular visual culture. Its aim is to show first, the lasting impact and power that both early and biased western visualizations of human ancestry have had in contemporary scientific education in Mexico; and second, the influence of non-Darwinian thinking of early twentieth century in Mexican representation of evolutionary theory. This in turn seeks to enlighten the global dynamics that shaped and reshaped local narratives.

Troubled Translations: Ethnoscience and Empire in Twentieth-century Philippines

Geoff Bil
New York Botanical Garden, Humanities Institute

Ethnoscientists play an invaluable role as exponents of biological and cultural diversity. This role has frequently been compromised, however, by the discipline’s close association with powerful imperial and colonial interests. This paper examines this tension in twentieth-century Philippines, with emphasis on the researches of two individuals: Elmer Drew Merrill (1876-1956), the most prominent botanist of the early years of American colonization; and Harold Conklin (1926-2016), the preeminent ethnoscientist after Philippine independence. The two represent vastly different ethnoscienctific paradigms. Merrill’s primarily economic interest in indigenous botany, which took shape under the auspices of an aggressively expanding colonial bureaucracy, is
epitomized in his encyclopedic effort to catalogue the vernacular names for useful Philippine plants from Spanish-language sources. Conklin’s research on Hanunó’o and Ifugao botanical classification, and on the connections between indigenous cultures and environmental knowledge, bolstered by facility in numerous indigenous languages, took shape in a vigorously nationalist postcolonial context. Yet the areas of overlap between the two men are equally intriguing: Conklin’s work drew upon military aerial surveillance photography, for instance, and he promoted his Ifugao studies as broadly relevant to projects of tropical “development”; while Merrill insisted on the ontologically stable character of indigenous plant classifications, and even patronized Conklin’s early ethnoecological research. In probing these connections and contrasts, this paper attempts a finely grained understanding of the spectrum of translational practices spanning apparently inconsonant frameworks for understanding differences between indigenous and Western patterns of environmental thought.

**Tuning the Blood Circuit: Gibbon’s Experimental Heart-Lung Machines between Control and Communication, 1930-1953**

Benjamin Prinz
_Bauhaus-Universität Weimar_

Heart-lung machines are key components of cardiac surgery. Their main purpose is to replace cardiopulmonary functions during surgical interventions in the open heart. While today’s heart-lung machines are robust and reliable devices, their early versions were highly precarious assemblages. When US surgeon John H. Gibbon, Jr. (1903-1973) started to develop the heart-lung machine in the 1930s, minor factors such as the irregular flow of blood through the tubes and vessels of machine and organism could quickly result in death. In fact, throughout all the stages of its development—from Gibbon’s early animal experiments to his successful cooperation with IBM following World War II—the heart-lung machine required meticulous strategies to control the blood flow. Based on new archival evidence, this paper reconstructs the development of the corresponding control systems, situating them within the material culture of their time. It argues that Gibbon’s work crucially relied on devices of and evolved from media technology: Gibbon started out by adopting instruments from telegraphy systems, but increasingly incorporated electronics derived from radio research laboratories. As a result, it will become clear that the heart-lung machine evolved within complex intersections between academic medicine, industrial research, and amateur radio.

**Turning Monkeys into Smokers and Smokers into Monkeys: When Behavioral Pharmacology Went Corporate**

Stephan Risi
_Stanford University_

In 1972, Claude Teague, the Director of Corporate Research at R.J. Reynolds, argued that the tobacco industry should think of itself as being "a specialized, highly ritualized segment of the pharmaceutical industry." Reynolds, he claimed, was ultimately in the business of selling a drug: nicotine. What had prompted this remarkable statement? In the 1960s, behavioral pharmacology revolutionized addiction research. Rats and monkeys, researchers showed, would press levers hundreds of times to obtain doses of drugs like heroin and cocaine. These experiments constituted a direct attack on the Freudian-inspired post-war consensus that drug use was a uniquely human fault, a maladaptive attempt to cope with an underlying personality disorder. But if animals self-administered drugs, who could argue that they did so because of their upbringing or social milieu? Behavioral pharmacology reoriented the study of addiction from psychological to biological explanations and helped to destigmatize drug use. But, as I show in my paper, it also effected a complete reorientation in the self-understanding of cigarette makers from tobacco manufacturers to nicotine merchants. Monkeys, new studies soon showed, would readily self-administer nicotine, showing that smoking was ultimately not about taste but about the nicotine. The discovery that smokers, as one industry
scientist put it, were "equivalent to monkeys pressing levers" set off a race to experiment with new tobacco strains and additives to make smoking more addictive. But behaviorism and its vocabulary of stimuli and reinforcers ultimately also provided the motivation to develop new fraudulent low-tar "light" and "ultralight" cigarettes.

**Two Sides of the Same Indian Coin: James Prinsep as Assay Master and Antiquarian in Mid-Nineteenth Century India**

Charlotte Coull  
*The University of Manchester*

The premature death of James Prinsep (1799-1840) was a massive loss to the British Orientalist community. In his twenty years in India his work was united by a common theme: coins. His role as Assay Master saw him perfect ways of measuring both high temperatures and precise weights, and his Indological hobby saw the translation of the ancient Kharosthi and Brahmi scripts using numismatic inscriptions. Prinsep’s singular career is an extreme example of the Orientalist polymath, with his varied interests enabled by the Indian colonial environment in which, as a result of the lack of pre-existing British knowledge structures, scholars often spread themselves thinly across a wide range of subjects under the umbrella of Orientalism. This paper argues that it was Prinsep’s linguistic work, taken up as a side occupation but pursued with the same if not more zeal than his assaying tasks, that began to encourage individuals to define more strongly their field of study and lose in part the polymath image. This is especially evident in the evolution of archaeology into a more defined discipline in the work of Prinsep’s successor, Alexander Cunningham (1814-1893). More broadly, this paper also questions whether Orientalism can be seen itself as a discipline, one which would benefit from complimentary historiographical approaches from both the history of sciences and the history of humanities.

**Uneasy Alliances: Analyzing the Role of Nation States in the Administration of Place-Based Science Sites**

Tiffany Nichols  
*Harvard University*

In place-based science, location is key to scientific inquiry. Thus, place-based science expands the focus from the rituals of laboratory practices within a laboratory to the actual placement of research in a landscape, on parcels of land often controlled by governmental or corporate entities. Although there is a deep understanding of the administration of the traditional laboratory space, analysis focused on the administration of place-based science is fairly new. This shift in focus produces questions, such as: In what ways has governmental control of land predetermined or created fields of scientific inquiry? How does such administration dictate siting, research protocols, experimental containment, and required alterations to the sites? Conversely, how does geographic specificity affect administration of research under place-based science? In addressing these questions, this panel will apply Scott Kirsch’s holistic concept of geographical histories, Peter Galison’s technical landscapes, and other new perspectives to place-based science sites administered by governmental entities. Each paper explores these concepts to explain and interrogate the role of the nation state in defining, administrating, and even hindering experimental spaces through the following place-based science examples: experimental stations in Central America, nuclear testing in the Marshall Islands, scientific infrastructure building on Cape Canaveral, and conducting physics on formerly active Cold War sites in the Western United States.

**Unwanted Pregnancies and State Secularization in Mid-Nineteenth Century Mexico**

Elizabeth O’Brien  
*University of Texas at Austin*

In 1871, an unmarried twenty-five year old woman in Mexico City reportedly "fell prisoner to an emotional suffering that drowned her in a state of indescribable
distress.” According to the obstetricians of Mexico City’s National Medical School, the señorita had become hysterical after having been impregnated and subsequently abandoned by her seductor. In order to restore her sanity, doctors insisted that the woman’s seven-month fetus should be expelled prematurely by means of a surgical procedure called artificial premature birth. This paper uses medical writings to explore how Mexican doctors drew on ideas about hysteria and organic lesions in order to re-conceptualize the boundaries between “natural” and “unnatural” pregnancies, and in order to experiment with surgical methods of ending unwanted pregnancies. It also suggests that their efforts were in open defiance of an 1869 Papal declaration, which declared that the termination of pregnancy at any stage was a grave sin that merited excommunication. These debates—about fetal personhood and the interruption of pregnancy—cannot be separated from the context of Mexico’s mid-century political climate, which was characterized by positivism in politics and scientific practice, on the one hand, and the secularizing impetus of Mexico’s liberal reforma, on the other. The paper suggests that artificial premature birth was not just a novel abortive procedure—it was also part of the secularization of Mexican reproductive science. Secularization—however partial and contested—seemed to have occurred not just in state functions, but also in the epistemologies and ideologies surrounding reproduction and fertility control.

Du Bois’s The Souls of Black Folk (1903) is required reading in high school and college classes, and those who read past the first chapter know that the book is based in part on his sociological research in Georgia and elsewhere. Moreover, it has recently been demonstrated by Earl Wright II and Alond Morris that Du Bois, through his pioneering Atlanta Conferences “for the study of the Negro Problems” (1898-1914), founded the first American school of sociology. But scholars have paid little attention to how Du Bois employed evolutionary ideas in his early sociological writings from 1897 to 1903. In this paper, I will demonstrate that Du Bois was interested...
in evolution in college, and was introduced to evolutionary debates in his Harvard classes; that both he and Alexander Crummell, one of his early mentors, sometimes echoed Herbert Spencer’s evolutionary language; that Du Bois viewed African-American institutions and African-American leadership as social evolutionary responses to a hostile environment; and that his sociological analysis of crime and poverty in The Philadelphia Negro (1899) depended on the idea of a mismatch between a social group and its environment. Thus, despite his later criticisms of Spencer’s “biological analogy” and “Social Darwinism,” Du Bois’s early sociology was developed in dialogue with the philosophy of evolution.

**We Have Never Been African**

Terence Keel  
*University of California, Santa Barbara*

This paper argues that the out of Africa hypothesis is an expression of Euro-American cultural beliefs that are, paradoxically, anti-social. These commitments can be traced back to the influence of Christian scholasticism on early modern naturalist thinking, where reverence for order and God’s impersonal design took precedent over our obligation toward the lives of created things.

Revisiting Darwin’s defense of monogenism, the UNESCO Statements on Race, and the emergence of the Out of Africa hypothesis in population genetics I show how these scientific claims are not oriented toward the social other or inculcating an ethical obligation to living things. Instead, “We are all African” celebrates the ability of science to render the human a natural object anchored to a stable (which is to say “asocial”) biological order.

“Black Lives Matter” and “We are all African” are therefore not commensurable truth claims. The latter is a type of knowing believed to occupy space outside the influence of religion, belief, historical precedent, and political commitments. The former is shaped by political, social obligations secondary to the more important task of locating black life within the larger biological system that governs the species homo.

**Weighing Water and Wine: Comparing as a Media Practice in Nineteenth-century Prussia**

Markus Krajewski  
*University of Basel*

My talk will explore the interdependence of exactitude in scholarly as well as scientific contexts in nineteenth-century Prussia. Focusing on the influential historiographic work of August Boeckh (1785-1867) on ancient metrology I will sound out the different notions of accuracy, exactitude and precision and how they are differentiated and adopted not only in the sciences but also in the realms of philology and historiography. A special light is shed on the media practice of “comparing” and how this technique can itself be compared to the practices of measuring in the sciences. The first half of the nineteenth century is thereby identified as the crucial period when the exactness of the exact sciences, as well as the notion of accuracy in the humanities, start to diverge from one another in order to develop an epistemic virtue each on its own.

**What is a Diagram? A Renaissance Tale**

Christoph Lüthy  
*Radboud University*

Diagrams are ubiquitous today, and we learn already at school how to read and make them. Their epistemic status is, however, curiously ill-defined. This was already the case when the term was first introduced from ancient Greek into Renaissance Latin and into the vernacular languages. In the period 1550-1650, the term “diagram” underwent a complex development, as it came to denote three visually similar types of graphic representations which possessed however quite different degrees of epistemic certainty. The term “diagram” referred, first of all, to mathematical constructions with ruler and compass, like the line constructions that in Euclidean geometry accompany mathematical proofs. Diagram of that first type literally possess demonstrative power, as the
concluding words QED (“quod erat demonstrandum”) at the end of a geometrical proof indicate. But quickly, the term “diagram” was also applied to schematic representations, for example in the domain of architectural drawings or machine albums. Diagrams of this type don’t yield any proof, but at least provide isomorphically accurate information. Thirdly, “diagrams” also referred to geometrical drawings that represented spatial alterations over time. This last type was often applied to innovative ends, but was clearly more problematic, as it neither furnished any demonstrative proof nor represented existing spatial relations. I will trace the Renaissance development of “diagram” and show which new possibilities of scientific argumentation it offered, but also, to which controversies its multiple status led. My examples of controversies will be taken from the domain of astronomy (Kepler vs. Fludd) as well as magnetism.

What’s (Not) in a Name? Insect Names in Early Modern Europe

Brian Ogilvie
University of Massachusetts Amherst

The common names of insects in use in Europe from the late Middle Ages through the middle of the eighteenth century did a poor job of capturing their immense diversity. While folk names for culturally relevant plants and vertebrates generally name a Linnaean genus, many insect folk names designate a family (such as “ant”) or even an order (“beetle,” “roach”). Hence, the artists, naturalists, and collectors who turned their attention to insects beginning in the sixteenth century faced a problem: how to designate their objects of study and description. The artists Maria Sibylla Merian, Johannes Goedaert, August Johann Rösel von Rosenhof, and Moses Harris, and the naturalists Francis Willughby, John Ray, Johann Leonhard Frisch, and René-Antoine Ferchault de Réaumur, employed a variety of strategies to name and distinguish insect species. The approach that each took was shaped by their place in the world of early modern natural history, but also by the nature of their interest in insects: indeed, it was possible to take an intense, life-long interest in them without feeling a need to name individual species at all. Early modern perceptions of insect diversity varied widely; they both shaped and were shaped by practices of naming.

What’s in a Name? The Persistence of an Endangered Desert Fish and the Science of Collecting and Classifying

Kevin Brown
University of California, Santa Barbara

Every member of the species Cyprinodon diabolis, the Devils Hole pupfish, lives and reproduces in a desert pool ten-feet across by sixty-feet long. In recent years, managers from Death Valley National Park have observed as few as thirty-five individual fish in this habitat. The whole species could fit in a pint glass and lives a habitat the size of a city bus.

A part of my book manuscript, this paper examines the science of naming and classifying the pupfish. Environmental historians are experts at showing how endangered species become embedded in the social, especially in fights over conservation, development, and identity. This paper elaborates on this body of work by integrating an insight from the history of science: “species” themselves are not neutral, timeless categories, but produced through a social-scientific process.

Focusing on the history of early twentieth century ichthyology, I show how the methods of collecting, storing, and classifying (through morphometric analysis) enabled the fish from Devils Hole to be defined as their own unique species. This process had important implications for the pupfish’s conservation—especially in the decision to add the habitat to the national park system—but also entailed substantial risk to the fish through the overcollecting of specimens. Scientists may have “saved” the pupfish through their naming, but simultaneously endangered them through the same process.
Who Murdered Haim Arlosoroff? The Politics of Acquittal in Interwar Palestine

Binyamin Blum
UC Hastings College of Law

On the night of June 16, 1933, Dr. Haim Arlosoroff, head of the Political Department of the Jewish Agency was shot while strolling along a Tel Aviv beach with his wife. Speculation was rife concerning the identity of the murderers: was this a sexual assault or robbery attempt or was this a political assassination? If the latter, were these Arab nationalists who had targeted a Zionist leader or were these anti-British communist operatives? Were these perhaps German agents who acted on the behest of Joseph Goebbels, the Nazi propaganda minister, whose wife had allegedly had a romantic encounter with Arlosoroff?

Given the high profile of the case, the murder investigation was overseen directly by the newly appointed head of the Palestine Police Criminal Investigation Department, Harry Rice. No forensic innovation was spared in determining the identity of the killers: from Bedouin trackers to ballistic and fabric analysis conducted by some of the most prominent forensic scientists of the time, Sydney Smith and Alfred Lucas. Ultimately, those prosecuted were members of Arlosoroff’s political rival, the Zionist Revisionist Party. Though the court found the two guilty beyond reasonable doubt, the two were acquitted on what amounted to a peculiar procedural technicality in Palestine law. I analyze the political considerations that led the court to exonerate on the one hand yet attribute the acquittal to a technicality rather than to the inherent weakness of the forensic evidence.

Why ‘Body’ Matters: Premodern Paradigms of Corporeality

Therese Cory
University of Notre Dame

Hardly anything seems more ordinary than the extended, concrete bodies populating the world of experience. Yet in explaining their manifest properties, physicists must appeal to entities radically unlike the bodies of our experience. Medieval Aristotelians too struggled to resolve tensions between the characteristics of the bodies we experience (corporeality), and the principle that accounts for the way bodies are (matter). This panel uncovers key difficulties that theorists of the High Middle Ages encountered when deploying Aristotelian notions of body to account for the bodies we experience. It thus offers a new window onto the fraying and reweaving of medieval paradigms of the physical world in the thirteenth century. The first three papers examine tensions within medieval paradigms of corporeality. Neil Lewis will explore medieval attempts to fit ‘body’ into the Aristotelian categorial scheme by distinguishing body as substance and quantified body. David Cory will examine the emergence of a ‘dual explanation’ of physical phenomena in terms of materiality and corporeality. Nicola Polloni will show how this duality raised questions about matter’s (un)knowability, putting its physical function into tension with its metaphysical limitations. The last two papers treat two cases, concerning bodily properties, that challenged Aristotelian paradigms among thirteenth-century Christian and Islamic intellectuals. Therese Cory will examine how Parisian theorists sought to integrate light into their paradigm of corporeality. Emma Gannagé will examine how the post-Avicennian medical tradition handled the problem of bodies exhibiting secondary qualities (magnetism or healing properties) beyond those manifested by all bodies in common.

Why Did the Number of History of Science Courses Increase in Japanese Higher Education after World War II? Influence of Postwar Advisors from the United States

Mai Sugimoto
Kansai University

This paper will provide a short overview of the emergence of history of science courses in Japanese colleges after World War II. The postwar reform of the Japanese education system was performed under
practitioners in the fields of psychology and psychiatry began to promote new attitudes toward soldiers with service-related psychiatric conditions. Van de Water articulated these new attitudes in articles and books about the psychology of American G.I.’s. A five-article series, written by Van de Water “to understand and help the returning soldier discharged for neuropsychiatric reasons,” ran in the April 22, 1944 issue of The Science News-Letter and was picked up by newspapers reaching 2-3 million readers. Van de Water’s humane consideration of the psychological concerns of soldiers, in the battlefield and back home, paved the way for the public to understand that stress disorders were not moral failings, that soldiers sometimes returned from war “wounded in mind” and that many of these soldiers could return to productive, satisfying lives if they received proper treatment. This paper briefly examines the evolution of our scientific understanding of post-traumatic stress disorder and places Van de Water’s writings on the topic in their historical context.

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**Wounded in Mind: Marjorie Van de Water of the Science Service and her Campaign for Humane Treatment of Battle-Weary World War II Soldiers**

Susan Swanberg  
*University of Arizona School of Journalism*

The Science Service, a news agency for the popularization of science, was established in 1921 by newspaper magnate, E.W. Scripps and scientist William E. Ritter. In 1929 the Service hired a young female writer, Marjorie Van de Water, to cover social science for its Science News-Letter and other Science Service publications. Van de Water focused much of her writing on psychology, including stories about wartime stress, the plight of the “fighting man,” and the condition we now call post-traumatic stress disorder. During World War II, researchers and