

Department III

Anonymous. n.d. [Table with laboratory equipment in the field].  
Photography. Università di Torino,  
Biblioteca Angelo Mosso



## Department III

# Experimental Systems and Spaces of Knowledge

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Director: *Hans-Jörg Rheinberger*

Department III is headed by Hans-Jörg Rheinberger. Most of the research activities of the department revolve around the practical, conceptual, and cultural conditions of scientific innovation. Since the early modern period, scientific activity has been associated with the exploration of novel, uncharted ground. Today, the sciences have become a predominant factor of social and cultural innovation; they have penetrated all domains of modern everyday life. But if the essence of science resides in the production of new knowledge, a question of fundamental importance arises for the historian of science: how do scientists manage to produce knowledge that can be considered reliable, although their work essentially deals with objects that still lie in the realm of the unknown, and although time and again they have to be ready to discard knowledge that was believed to be certain?

In one way or another, the projects of Department III are devoted to exploring the dynamics of scientific change. The working group on the experimentalization of life focuses on the relation among science, technology, and the arts around 1900. The working group on the cultural history of heredity explores the long-term changes in the very concept of heredity. And the working group on knowledge in the making centers on the activities of drawing and writing as exploratory techniques in science, art, and literature. Many, although not all by far, of the case studies are located in the broad field of the life sciences: from the beginnings of the exploration of heredity in eighteenth-century agriculture and medicine to the most recent developments in molecular genetics; from classical and romantic natural history to experimental physiology; from gardening around 1800 to synthetic biology of the present.

Within the last 150 years in the sciences, the constellations of expertise, of model organisms, instruments, and experimental arrangements have developed into separate disciplines with remarkable stability, physiology being a good example. But disciplines have also dissolved, such as, most recently, molecular biology, and given way to new and different research fields. Experimental objects, instruments, methods, concepts, and specialists have changed fields; they have been reconfigured in ever-new constellations with concomitant unprecedented developments.

To explore these dynamics in depth, the research projects of the department are organized around topical domains with a long-term perspective, embedded in a multidisciplinary horizon. The individual projects of the research scholars usually take three to five years, those of the postdoctoral fellows two years. New projects are selected in such a way as to provide a certain amount of overlap with ongoing research activities in one of the domains. This allows for the development of individual research agendas, while encouraging the emergence of new common projects extending over disciplinary and epochal boundaries.

For many years, the department has also worked on the development of a “Virtual Laboratory.” The Virtual Laboratory is a web-based platform devoted not only to collecting and making accessible a broad range of textual and pictorial sources, but also to constructing an electronic research and publication environment.

Since the founding of the department in 1997, three topical domains have shaped our work. They will briefly be described before reporting on the work in the period between 2006 and 2007.

### **History and Epistemology of Experimentation**

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Philosophers and historians of science agree that since the early modern period, the experiment has been at the center of the process of knowledge creation. Detailed investigations on the varieties of experimentation, however, are of relatively recent origin. Indeed, upon closer inspection, it turns out that there is no such thing as “the” experimental method. Rather, different forms and styles of experimentation have developed over time and are to be distinguished from one another. They are connected with particular phases of scientific work, and they characterize particular experimental cultures of certain time periods or disciplines. In addition, experiments often gain a life of their own that leads researchers away from their original goals and convictions. Often enough, phenomena that initially were seen as artifacts or disturbances became the center of attention, and methods that were seen as unproblematic data collection devices moved into the focus of epistemic interest. The historical dynamics of the sciences can only be understood properly if all possible forms of experimentation are taken into account in their own right, without elevating one of them to an ahistorical model of “the” good experiment.

### **History of Objects and Spaces of Knowledge**

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A decisive aspect of scientific innovation lies in selecting, adapting, and at times also turning away from particular objects. Unicellular organisms, sense organs, or populations, for instance, are not scientific objects in and of themselves; they become scientifically meaningful only inasmuch as they come to represent interesting phenomena such as organismic reproduction, the boundaries of perception, or supra-individual biological processes. Model organisms are a particularly interesting category

of objects for the history of the life sciences in this context. These objects, as a rule, are embedded in real and symbolic spaces within which they are manipulated, and which they shape in turn. Natural cabinets, laboratories, the “field” of the zoologist or the anthropologist, but also “virtual” environments, such as the paper surface of the laboratory protocol or computer simulations are instances of such spaces whose emergence and configuration we investigate in historical detail.

### **Formation of Concepts and Uses of Theory**

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Not least, processes of scientific innovation express themselves in the formation of new concepts and theories. We are less interested in a traditional history of ideas and concepts than in the concrete roles concepts and theories play in scientific practice. We are interested in the organizing function of concepts when experiments are being devised and conducted; in their role in the creation of research domains and scientific disciplines; in the relations between verbal and pictorial argumentation in the historical development of the life sciences; in the movement of metaphors between scientific and extra-scientific texts; and in particular in the function of writing and drawing in the emergence of figures of thought.

Together, the research projects of Department III contribute to a perception of the dynamics of scientific research that is characterized, above all, by historical contingency. Within the history of the sciences, whole disciplines derive their origin from accidental constellations of technical artifacts and their further development depends on achievements that may have their point of departure in other disciplines. The dissemination and solidification of technologies may result, and in their new form, may impinge on neighboring areas. There appears to be no “logic” of research that would, based on one particular method, forever yield scientific progress toward an anticipated goal. An idea that counts as revolutionary for today’s science may reveal itself as an obstacle tomorrow; a technology that has beneficial applications now may deploy destructive effects in the future. Science, as a thoroughly human undertaking, has to be analyzed in all its historical and cultural ambivalence.

Project

## Experimentalization of Life

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RESEARCH SCHOLARS *Julia Kursell, Henning Schmidgen*

POSTDOCTORAL FELLOWS *Philipp von Hilgers, Britta Lange*

PREDOCTORAL FELLOWS *Christian Reiß, Sandra Pravica, Viola van Beek, Katrin Solhdju, Björn Brüsch*

VISITING SCHOLARS *Elfrieda and Erwin Hiebert, Rand B. Evans*

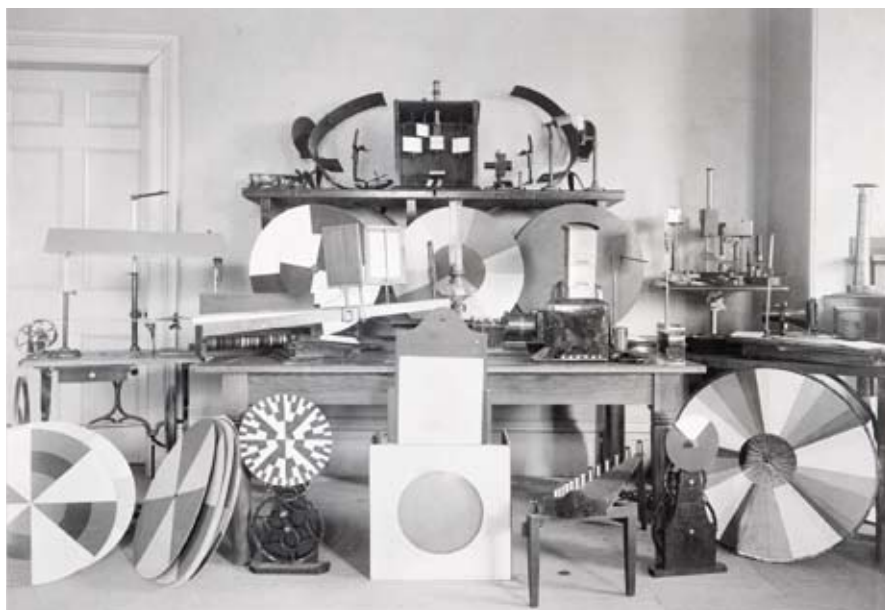
COLLABORATIONS Bauhaus Universität Weimar (Fakultät Medien); Hermann von Helmholtz-Zentrum für Kulturtechnik (Humboldt-Universität zu Berlin); Zentrum für Literatur- und Kulturforschung, Berlin; Freie Universität Berlin (Institut für Deutsche und Niederländische Philologie)

FUNDING VolkswagenStiftung, “Focus on the Humanities” of the Fritz Thyssen Stiftung and the VolkswagenStiftung, MPIWG

### General Description of the Project

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Focusing on the history of the experimental life sciences, the project develops a cultural history of experimental systems. It deals with the spaces, bodies, and traces that emerged in and were created by the “experimentalization of life” during the nineteenth and early twentieth centuries—inside and outside of laboratories. In particular, the project investigates experiments that were carried out in spaces such as soundproof rooms and test tubes, the physiological laboratory and the horticultural institute, prisoner of war camps and entire cities. It studies experimental practices involving cells and tissues, eyes and ears as well as nerves and brains taken from hu-



Anonymous. 1892. Harvard Psychological Laboratory in Dane Hall: Instruments for Experiments on Sight. Photograph. (Harvard University Archives call # HUPSF Psychological Laboratories (7))

man and animal bodies. It also explores the drawings, protocols, and notes of laboratory scientists, naturalists, and architects, comparing and contrasting them to marks produced by means of kymographs, ergographs, gramophones, and cinematographs. While describing and investigating these cultures of experiment in various contexts, the overall aim of the project is to contribute to an “epistemology of disturbances.” The project highlights the role of friction, resistance, and misreadings as crucial aspects of the material and semiotic processes that lead to the production of experimental knowledge in science, technology, and the arts.

Experimentalization of Life

### Individual Projects

*Julia Kursell* (Research Scholar)

#### Historical Epistemology of Hearing (1850–2000)

The project investigates key concepts and practices that have contributed to our present understanding of sound, hearing, and music. After 1850, knowledge of acoustics, which had been guided by the symbolic code of music well into the nineteenth century, began to be transformed into an experimental science of hearing. Through research on the history of media and the material culture of experimentation, the aim of this project is to show the understanding of hearing as historically changing, and thereby contribute to the current reorientation of research in the human sciences that deal with sound, hearing, and music.



Julia Kursell



Fingerprints from piano pedagogue and pianist Elisabeth Caland, registered by pianist Marie Jaëll and psychologist Charles Féré. (BNU Strasbourg, Fonds Marie Jaëll)

The project is divided into three parts, each of them focusing on a different historic constellation. The first part is a book project titled “Ear and Instrument—Hermann von Helmholtz’s *On the Sensations of Tone as a Physiological Basis for the Theory of Music*,” which analyzes the relation among physiology, psychology, and the aesthetics of the acoustic around 1850. In 1856, Helmholtz started to work on the physiology of hearing. He developed a theory of hearing, according to which the ear analyzes complex waveforms by resolving them into their sinusoidal components. The devices used to study this theory produced sounds that were not present in nineteenth-century music, and the aesthetics of music that Helmholtz had called upon to corroborate the physiological theory of hearing eventually collapsed. If Helmholtz left it to aesthetics to draw the line between sound and music, the music of the 20th century, in the wake of Helmholtz, abandoned this distinction. In other words, his treatise *On the Sensations of Tone* suggested aesthetic experiments whose outcome was open.

The second part, “Experimentalization of Hearing: Moscow 1920–1930,” deals with attempts to reconcile the diverging disciplines of aesthetics and scientific investigation into hearing in the early Soviet Union. Part three, “Music and Media after 1945,” explores the history of composition from the perspective of media studies. In musical composition of this time, knowledge of the mechanisms of hearing came to be a prerequisite for the creation of music.



Henning  
Schmidgen

*Henning Schmidgen* (Research Scholar)

### **Chronos and Psyche: The History of Physiological and Psychological Time Experiments**

This project deals with the history and epistemology of physiological and psychological time experiments. Following Hermann von Helmholtz’s pioneering investigations into the propagation speed of stimulations in living nerves, a considerable number of nineteenth-century scholars started studying the time animal and human organisms require to respond to stimuli of all kinds (optical, acoustical, tactile, etc.). After 1850, two main strands of research were established. On one side, the investigations of scholars such as Albert von Bezdold, Gabriel Valentin, Julius Bernstein, and Etienne Jules Marey contributed to defining and demarcating, within physiology, the field of “nerve and muscle physics.” On the other side, the time experiments conducted by Franciscus Donders, Wilhelm Wundt, Edward Scripture, Hugo Münsterberg, and Alfred Binet led to the establishment of “experimental psychology.”

Instead of merely accepting these disciplinary and/or institutional labels, the project argues that these developments can be studied as the history of one experiment, or “experimental system,” that emerged and evolved over time, while bifurcating in sometimes surprising ways. As a consequence, the concrete materiality of experimental set-ups is emphasized, as are the interactions among scientists, model organisms, and instruments that the set-ups entailed, and the technological as well as architectural surroundings that framed these practices. This approach provides the basis for demonstrating that physiological and psychological time experiments formed a network of “research machines” that constituted the backbone of theoretical debates and institutional developments.



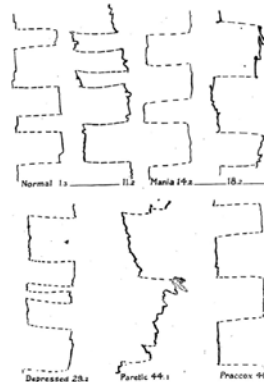
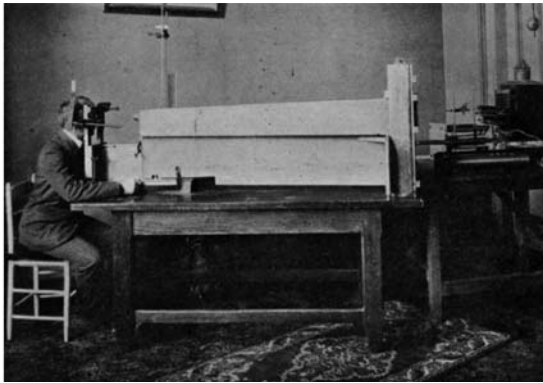
*Philipp von Hilgers* (Postdoctoral Fellow)

### Mapping the Field of Vision: From Experimental Investigations of Reading to Pattern Recognition, 1860–1960

Reading is one of the oldest cultural-technical achievements. However, around 1900, novel experimental practices transformed the process of reading into an object of scientific inquiry. This project investigates the extent to which the introduction of time-dependent media such as kymography and cinematography contributed to a rather dramatic shift in experimental perspectives: in reading studies, evidence was no longer provided by the human eye or attention, but by the frame of the recording media. As the paradigmatic investigations of Benno Erdmann and Raymond Dodge (1898) show, the new research on reading was characterized by two aspects. First, the instrumentally mediated perception of letters led to new knowledge about vision, revealing the constitutive role of small intervals of time. Second, the perception of single letters was no longer conceived of as an isolated mental act, but rather as a physiologically extended and time-consuming process.



Philipp von Hilgers



Raymond Dodge's photochronograph for recording eye movements and the reproductions of various graphs of "healthy" and "mentally ill" readers. Allen R. Diefendorf and Raymond Dodge, "An experimental study of the ocular reactions of the insane from photographic records," *Brain* 31: 451–489, on p. 456, 1908

The project traces the steps from Erdmann and Dodge's research to the work of Warren McCulloch, Jerome Lettvin, Humberto Maturana, and Walter Pitts. This group of researchers carried out their studies in the era of cybernetics. Their experiments, which were defined by the possibilities of electron microscopy and electronic devices, led them to conclude that cognitive events were the result of the activity of nerves rather than the result of eye or body movements. In particular, the frog's retina was regarded as an independent neuronal net with its own inherent logic and tendency to code visual signals in a qualitative way. This logic could be translated onto paper, i. e., transformed into mathematical models. At the same time, it was conceived of as a potential system of electronic circuits.

Against this background, the project argues that new techniques can lead to radical breaks with the state of research that immediately preceded them. It also demonstrates that epistemic concepts can contribute to re-introducing almost forgotten theoretical models back into laboratory practice. These epistemic "folds" call for a broad but simultaneously deep approach to the history of science.



Britta Lange

*Britta Lange* (Postdoctoral Research Fellow)

### **A History of the Typical: Scientific Research in Prisoner-of-War Camps from 1915 to 1918**

During the First World War, the governments of Germany and Austria encouraged scientific commissions to conduct studies in prisoner-of-war (POW) camps. Between 1915 and 1918, physical and cultural anthropologists, comparative philologists, linguists, musicologists, and lawyers gathered extensive data on “human material.” These scholars considered the camps to be ethnographic research fields imported into Europe. In their eyes, the prisoners represented almost all foreign “nations” or “races,” as the Central Powers waged war against the “whole world”—the other European nations and their colonies as well as against the Russian Empire and the United States.



Prisoners of war (here: Tatars) in front of an Edison phonograph, supervised by Carl Stumpf (right) and Georg Schünemann (center) from the Berlin Phonographic Commission. Wilhelm Doegen (ed.), *Unter fremden Völkern. Eine neue Völkerkunde*, S. 145, Berlin 1925

This project investigates the production and reproduction of the “typical” in this partly observational, partly experimental context: What were the (standardized) methods, presumptions, and strategic interests (e.g., personal and/or national competition) of the scholars involved? How did the specific conditions of the camp as well as the available recording technologies facilitate the distribution of images, voices, and body movements deemed to be “typical” of specific human races?

Based on recently discovered archival material, the project demonstrates how German and Austrian scientists (among them Felix von Luschan and Rudolf Poech) were eager to find and collect “typical” examples of different ethnic groups, so-called *Völkertypen* and *Rasstypen* using statistical methods that relied on complicated measurements, or simply by “seeing” and “feeling” the typical. These scientists not only wrote detailed descriptions of selected prisoners, they also took finger- and footprints, made plaster casts of hands, feet, and heads, and they produced phonographic and cinematographic recordings. Most of the POW camp scholars tried to implement pre-existing models of the “typical” in their field research. But as the example of physical anthropologist Egon von Eickstedt shows, they sometimes also realized that their mathematically deduced “racial types” differed significantly from what they

had taken to be “types” by watching and photographing the prisoners. This seems to be the ultimate irony of the POW camp research that this project investigates: scholars reported less on the “types” they had found, but much more on the problems in defining human “types.”

*Christian Reiß* (Predoctoral Fellow)

### **The Way into the Laboratory: The Origins and Role of Model Organisms in the Experimental Life Sciences**

This project investigates the role of model organisms in nineteenth- and early-twentieth-century physiology and zoology. Beginning in the mid-nineteenth century, experimentation became the method of choice in these fields. However, for successful experiments to be conducted, organisms had to be chosen, brought into the laboratory, stabilized, and finally integrated into the experimental setup.

The project argues that this process can neither be considered linear nor entirely driven by scientific rationality. One of the project’s key examples is the Mexican axolotl (*Amblystoma mexicanum*), an amphibian nearly extinct in its natural habitat, although it populates aquariums in laboratories, households, and zoos all over the world. Initially brought to Paris in the course of France’s colonial activities in the 1860s, curiosity soon turned this organism into a scientific object for studies concerning evolution, ontogeny, and physiology. At about the same time, aquarium fanciers started to adopt the axolotl as one of their most popular “pets.” As this project shows, both developments went hand in hand, influencing each other by transfer of knowledge and technology. As a result, the axolotl was turned into a paradigmatic laboratory animal in the late nineteenth and early twentieth centuries. Among others, August Weismann (1834–1914) and his assistant Marie von Chauvin played an important role in turning the axolotl into a laboratory animal. Taking the axolotl’s case as a model, the project emphasizes the history of animals in their specificity, tracing their trajectories across disciplines, across the border between science and the public as well as across the great divide between “civilized” and “colonized” countries.



Christian Reiß

*Sandra Pravica* (Predoctoral Fellow)

### **The Experimental Epistemologies of Gaston Bachelard and Edgar Wind**

This project is concerned with changes in epistemological accounts of scientific experimentation around 1930. The focus in the history of science on experimentation is usually considered to date only to the 1980s and 1990s. This recent “practical turn” has led philosophers and historians to reconsider various aspects of the process of producing, stabilizing, and objectifying scientific knowledge in the laboratory. In contrast, this project focuses on the 1930s and demonstrates that authors such as Gaston Bachelard and Edgar Wind chose experimentation as the key topic for epistemological reflection. Explicitly inspired by the upheavals of quantum physics and the theories of relativity, Bachelard and Wind relocated traditional problems in the philosophy of science to the realm of means and instruments of scientific research. In addition, they adopted a broad range of notions from biology, evolutionary theo-



Sandra Pravica

ry, experimental psychology, musicology, and other discourses, e.g., “emergence” or “rhythm.” In doing so, it will be argued, both authors developed strategies for opening the discourse of philosophy of science, from within, to practices of experimentation and suggested instructive approaches to “science as culture.” Through a close study of Bachelard’s and Wind’s creative use of concepts, this project shows that, by distancing themselves from the normative projects in contemporary philosophy of science, the two authors proposed epistemologies that were constantly challenged by their applications and, more generally, by scientific innovation per se. The primary objective of this project is to spell out the philosophical and historical implications of these “experimental epistemologies.”



Viola van Beek

Viola van Beek (Predoctoral Fellow)

### Codes of Experimenting and Experimental Spaces Around 1900

Around 1900, the experimentalization of everyday life manifested itself as the revitalization of genres such as the experiment book, the widespread presence of experimental or avant-garde literature, the popularization of hands-on experiments in educational institutions like the *Urania* in Berlin and, above all, the widespread use of experiment kits for children. These kits started to become increasingly popular in the 1920s.



Experiment kit “Elektro” by Kosmos.  
Franckh’sche Verlagshandlung, around 1930  
(private/Deutsches Museum, München)

This project investigates how this largely neglected genre contributed to the creation of experimental spaces outside the laboratory, in particular by providing specific “codes of experimenting.” More than mere provisional set-ups at home experimental kits explicitly connected themselves to everyday things as objects of investigation and everyday knowledge as their framework of reference. Moreover, in their role as portable laboratories, chemistry sets, electricity kits, and physical cabinets (which, in their adult version, had already accompanied traveling scientists and intellectuals throughout the previous century) functioned as extensions of classrooms and lecture halls. To amateurs and dilettantes, they were available through trade catalogs and early forms of “mail-order” catalogs. The kits, which consisted of instruments, substances, and supplementary contents arranged in wooden, metal or paper boxes, illustrate the opening and expansion of experimental spaces in an exemplary manner. Together with their instruction manuals, the miniature laboratories provided structures in which experiments took place or *could* take place; as a result, they had

their own agency in the process of experimenting and reflecting knowledge and were not mere containers for experimentation. Instead this project suggests seeing them as creating novel spaces of knowledge that refer back to and unlock the experimental subject interacting with things.

*Katrin Solhdju* (Predoctoral Fellow)

**Self-Experimentation: Crossing the Borders between Science, Art, and Philosophy 1840–1920**

The aim of this project is to investigate the theories of knowledge that are inherent in experiments carried out on the researcher's own body and/or mind. At the same time, it explores how different practices of self-experimentation contributed to changing and shaping concepts of subjectivity and self-ness and vice versa. Three case studies are at its center. The first is devoted to Henry Head's neurological self-experiments on the recovery process, the second deals with drug-induced madness as investigated by French psychiatrist Jacques-Joseph Moreau de Tours, and the third focuses on the philosophical impact of Benjamin Paul Blood's self-experiments with laughing gas. On the basis of detailed historical and conceptual analyses, the project develops a theory of knowledge that highlights proximity and closeness rather than distance and neutrality, processes of subjective knowledge production rather than objective results of scientific investigations. Its main argument is that self-experiments expose a kind of knowledge production that forms a "minority" in the history of modern experimentation. In contrast to the dominant quest for objectivity, these experiments express and translate a "will" to adequately address phenomena that refuse to be approached in non-subjective ways.



Katrin Solhdju

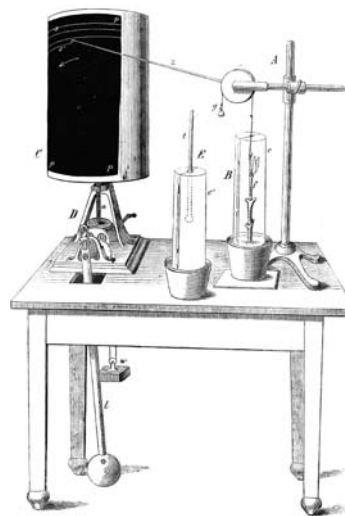
*Björn Brüsch* (Predoctoral Fellow)

**The Experimentalization of Gardening in Nineteenth-Century Germany**

Much of the promotion of Prussian "Landeskultur" in the early nineteenth century was closely connected to the use of the land as gardens. This project shows how this dynamic connection resulted in the establishment of an institution specifically aimed at providing gardeners with comprehensive scientific education: the *Königliche Gärtner-Lehranstalt* in Wildpark/Potsdam. Based on extensive archival material, the project reconstructs how the political, economic, cameralistic, practical, and aesthetic ideas of Karl vom Stein zu Altenstein, Peter Joseph Lenné, Karl Cranz, and others contributed to the formation of the Potsdam school for gardeners. It also demonstrates how this institution, in the process of its establishment, floated between Lenné's program of scien-



Björn Brüsch



Auxanometer for determining and measuring growth in plants.  
Julius Sachs (ed.), *Arbeiten des Botanischen Instituts in Würzburg*. 1: 113, 1874

tific gardening and Cranz's practical horticultural orientation. While Lenné aimed at attaining intellectual respect for gardening by introducing a scientific and experimental approach, Cranz (and Altenstein) intended to provide gardeners with the basic skills that were deemed to be important in the cultivation of the Prussian land. By merging agrarian and horticultural utility, experimental cultivation and visual splendor, the *Gärtner-Lehranstalt* supported the state's basic industries in terms of an encompassing garden culture.

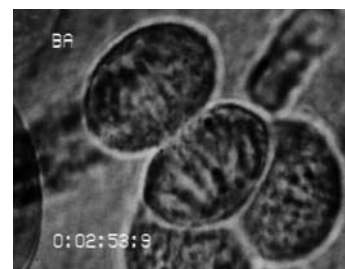
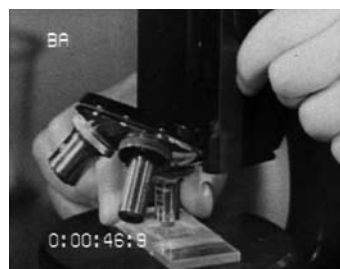
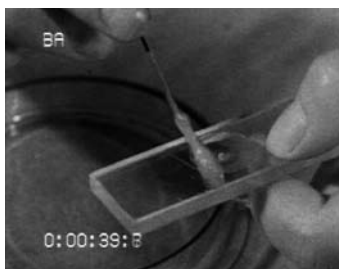
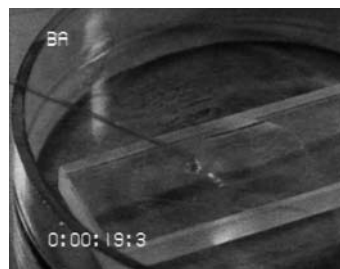
## Experimentalization of Life

### The Virtual Laboratory

[<http://vlp.mpiwg-berlin.mpg.de>]

The "Experimentalization" project created and continues to use and develop a "Virtual Laboratory" (VL). Online since 2002, the VL has become a unique archive and research tool for the history of the experimental life sciences in the nineteenth and early twentieth centuries. Currently, it offers more than 30,000 complete bibliographical references and displays a total of some 6,500 scanned items consisting of about 5,200 journal articles, 360 book chapters, 190 monographs and textbooks, as well as 180 trade catalogues of scientific instruments. In addition, it gives access to some 200 items that were digitalized in cooperation with archives and museums, including laboratory notebooks, article manuscripts, letters, graphical recordings, and photographs. Currently, the VL is extending its scope by integrating scientific films and phonographic recordings. In cooperation with institutions such as the Bundesarchiv-Filmarchiv, Berlin, and Berliner Phonogramm-Archiv, a collection of physiological and medical films, covering the span from the 1920s to the 1950s, are being included in the collections of the VL as are numerous wax-cylinder recordings of acoustic experiments from the period between 1900 and 1920. Similar projects were started with the Staatsinstitut für Musikforschung PK, Berlin (library collection on acoustics and instrument making), and the Museum für Naturkunde, Berlin (photograph collection).

Stills from a movie ("Hochschulfilm-Nr. C 507") on the production of tissue cultures. ca. 1940 (Bundesarchiv-Filmarchiv, Berlin)



As a research tool, the VL continuously enhances its search options. In addition to simple and advanced searches on bibliographical records, it offers similar exploration tools for the image database containing some 20,000 fully referenced and captioned drawings, curves, and photographs. At the same time, the VL has embedded search tools for specific purposes, e.g., the “trend-scout” for statistical analyses of bibliographical references over time.

Since 2006, the VL has provided users with a new work environment called myLab. This environment allows building, managing and sharing personal sub-sets of annotated objects found in the VL (bibliographical references, scans of published and/or unpublished texts, short biographies, sites) and beyond. myLab has proven to be an excellent teaching tool and is used by project members in their teaching on a regular basis.

The VL also offers highly attractive and powerful space for scholarly publication. Its essay section publishes short articles about the ongoing research work of the Experimentalization project. Articles are linked to other holdings, including short biographies, laboratory descriptions, and instruments in the digital library and other sections of the VL. Scholars from outside who are working on related topics and sources have started to use the publication site, which will be developed into a refereed online journal in the near future.



Assemblage of instruments used in Angelo Mosso's alpine physiology consisting of pick-axe, lantern and mitten. (Angelo Mosso Papers, Turin)

## Experimentalization of Life

### Activities Related to the Project

- Workshops and Exhibitions

“ZwischenRäume”: Castles in the Air; Idées fixes; Time Leaps. Three workshops organized together with the Helmholtz-Zentrum für Kulturtechnik (HU), the Zentrum für Literatur- und Kulturforschung, and the Institut für Deutsche und Niederländische Philologie (FU). Berlin, June 30, 2006, January 26 and June 15, 2007. “Physiologie des Klaviers.” Concerts and talks, organized by Julia Kursell, together with the Musikinstrumenten-Museum SIMPK. Berlin, October 5 and December 12, 2006, and February 15, March, 8, April 12, May 3, June 7, July 5, and October 24, 2007.

“Introspective Self-Rapports: Shaping Ethical and Aesthetic Concepts 1850–2006.” Workshop organized by Katrin Solhdju. Berlin, May 5–6, 2006.

“A Glance into the Prime of Prussian Culture: Karl Friedrich Schinkel's *Blick in Griechenlands Blüthe* and Prussian Cultural Narratives around 1820.” Workshop organized by Björn Brüsch. Berlin, May 12–13, 2006.

“Sounds of Science.” International Conference organized by Julia Kursell. Berlin, October 5–7, 2006.



Poster to the series of talks and concerts “Physiologie des Klaviers”, organized by Julia Kursell in collaboration with the Museum for Musical Instruments (SIMPK), Berlin. 2006/2007

“Life and Societies: Toward a New Ecology of the Living.” International conference organized by Henning Schmidgen and Didier Debaise. Berlin, November 3, 2007.

“The Halfmoon Files: An Exhibition on Sound Recordings of POWs in Germany, 1915–1918,” organized by Britta Lange together with filmmaker Philip Scheffner. Kunstraum Kreuzberg/Bethanien, Berlin, December 2007 to February 2008.

“The Ambivalence of Archives.” Workshop organized together with the Helmholtz-Zentrum für Kulturtechnik and the Institut für Medizingeschichte (both HU). Berlin, January 17–18, 2008.

- Completed Dissertations
  - Björn Brüsch, “The Advancement of Prussian Land and Culture: From the Horticultural Use of the Land to the Foundation of the Royal School for Gardeners” (2008).
  - Katrin Solhdju, “Becoming Perspectival. Self-experimental Practices in the Sciences and their Philosophies (1840–1920)” (2008).
- Books
  - Philipp Felsch, *Laborlandschaften: Physiologische Alpenreisen im 19. Jahrhundert*, Göttingen: Wallstein, 2007.
  - Margarete Vöhringer, *Avantgarde und Psychotechnik: Wissenschaft, Kunst und Technik der Wahrnehmungsexperimente in der frühen Sowjetunion*, Göttingen: Wallstein, 2007.
  - Julia Voss, *Darwins Bilder: Ansichten der Evolutionstheorie 1837–1874*, Frankfurt am Main: Fischer Taschenbuch Verlag, 2007.
  - Sven Dierig, *Wissenschaft in der Maschinenstadt: Emil Du Bois-Reymond und seine Laboratorien in Berlin*, Göttingen: Wallstein, 2006.



- Upcoming Events

“Physiologie des Klaviers II—Vorträge und Konzerte zur Wissenschaftsgeschichte der Musik.” Concerts and talks, organized by Julia Kursell. Berlin, January 23, March 6, April 9, and June 11, 2008.

## Project

# A Cultural History of Heredity

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RESEARCH SCHOLARS *Hans-Jörg Rheinberger, Christina Brandt, Bernd Gausemeier*

POSTDOCTORAL FELLOWS *Maria Kronfeldner*

VISITING SCHOLARS *Edna Suárez-Díaz*

SHORT-TERM GUEST RESEARCHERS *Carlos López Beltrán, Jonathan Harwood, Manfred Laubichler*

COLLABORATIONS ESRC Centre for Genomics in Society, University of Exeter (Staffan Müller-Wille); Universidad Nacional Autónoma de México (UNAM); School of Life Sciences at Arizona State University, Tempe; Center for Literary and Cultural Research, Berlin

FUNDING Government of Liechtenstein, DFG, German Academic Exchange Service (DAAD), British Council, British Academy, Conacyt (Mexico), and MPIWG

## General Description of the Project

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This project centers on the history of the scientific and technological practices in which knowledge of biological “heredity” became materially entrenched and the cultural contexts in which it unfolded its effects. Knowledge of heredity is taken here as encompassing much more than the scientific discipline of “genetics,” namely a knowledge regime in which a naturalistic conception of inheritance gradually formed that came to influence all areas of modern society, including medical, jurisdictional, and political discourses. The aim of the project is to explore the changing practices, standards, and architectures of this regime as well as their particular historical conjunctions from a *longue durée* perspective.

The project is collaborative and interdisciplinary in its nature. It aims to draw together expertise from the history of science as well as other historical disciplines such as the history of medicine, law, economics, and art as well as political history and anthropology.

The backbone of the project is a series of five workshops, each concentrating on a specific “epoch” in the cultural history of heredity. The first, extending from the late seventeenth century to the 1780s, is the period in which heredity came into exist-

tence in several distinct fields, such as horticulture and pathology. During the second epoch, lasting to the middle of the nineteenth century, heredity became central to the life sciences. In the third, covering the period from 1870 to the 1930s, heredity became experimental and mathematical. During the fourth, from the 1930s to the 1970s, heredity went “molecular.” And, finally, the fifth epoch, from the 1970s to the present, was characterized by the technological application and commodification of hereditary knowledge.

Three international workshops, focusing on the period from the seventeenth through the nineteenth century, took place in 2001–2005. In collaboration with the ESRC Centre for Genomics in Society, a fourth international conference on “Heredity in the Century of the Gene” was held at the University of Exeter in December 2006. Results of the first two of these workshops are presented in an essay collection published by MIT Press in 2007: *Heredity Produced. At the Crossroads of Biology, Politics, and Culture, 1500–1870*. A second volume is currently in preparation.

## A Cultural History of Heredity

### Individual Projects

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Staffan  
Müller-Wille



Hans-Jörg  
Rheinberger

*Hans-Jörg Rheinberger* (MPIWG, Director) and *Staffan Müller-Wille*  
(Senior Researcher, Exeter)

#### **Heredity. History and Culture of a Concept (Book Project)**

Over the past two years, Hans-Jörg Rheinberger and Staffan Müller-Wille have been working on a book project aimed at a broader academic public and dealing with the *longue durée* history and culture of the concept of heredity from the early modern period to the recent developments in genomics. In this book we try to understand why it took such a long time for heredity to become a central figure of thought in the life sciences, and why it gained such overwhelming importance in the life sciences and the broader culture during the twentieth century. The first chapter of the book deals with premodern theories of generation. In the second chapter, we look at the formation of hereditarian thinking in dispersed domains such as politics and law, medicine, and in natural history, breeding, and anthropology from the eighteenth to the early nineteenth century. The third chapter focuses on early hereditarian syntheses in the life sciences of the later nineteenth century. Chapter four addresses heredity, race, and eugenics around the turn from the nineteenth to the twentieth century. The fifth chapter deals with the formation of genetics, and therefore heredity, as a discipline during the first decades of the twentieth century. Chapter six is devoted to the rise of molecular genetics around the middle of the twentieth century. Chapter seven gives an outlook on recent developments in gene technology and genomics as a new biotechnological regime.

*Christina Brandt* (Research Scholar)

### **Reproduction in Biology. Configurations between Science and Culture, 1900–2000**

Today, biomedical research on reproduction and research on related topics such as stem cells are rapidly developing fields with controversial impacts on society and culture. Rather than concentrating on a specific disciplinary research field, Christina Brandt takes a broad look at the history of reproduction in biology.



Christina Brandt

“Reproduction” has a variety of meanings: it relates to different ways of propagating and multiplying, and it also refers to ways of making things similar or identical. In the latter sense reproduction means “replication” and has a bearing on molecular copying and cloning techniques. The fundamental role reproduction played, both as a subject under study and as an experimental technique, in twentieth-century life sciences is explored through a number of case studies dealing with reproduction research on the level of molecules, cells, and organisms. The focus is on (1) the history of cell biology (the emergence and reproduction of cell lines), (2) molecular biology and genetic engineering (the notion of replication and molecular copying techniques), and (3) developmental biology and embryo research. Here, a particular line of research concentrates on the history of cloning. This part of the project explores the emergence of the “clone” as a technical and epistemic object in different experimental systems and their cultural dimensions throughout the twentieth century. On an epistemological level, the study addresses questions of the relationship between material research practices and concept formation in twentieth-century life sciences.



In the 1970s, debates on cloning focused on the issue of serial replication: cover of the journal “Bild der Wissenschaft”. July 1979

*Bernd Gausemeier* (Research Scholar)

### **Genealogy and Human Heredity in Germany in the Late Nineteenth and Early Twentieth Centuries**

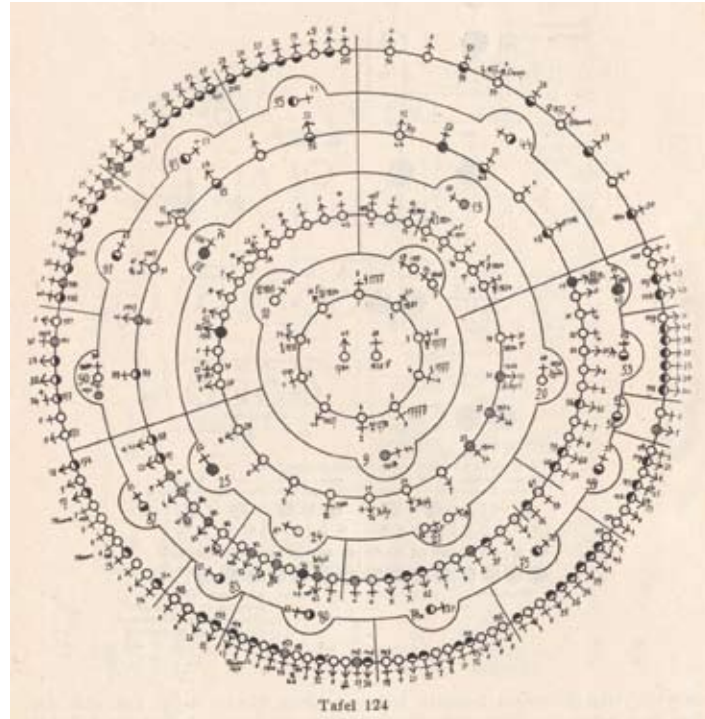
Genealogy was essential for the formation of a science of heredity as it provided the material basis of knowledge about hereditary transmission in various fields, including medicine, psychology, and animal and plant breeding. Yet genealogy is about more than the depiction of pedigrees and lineages. It reflects prevailing ideas about kinship and social order. A look at genealogical practices in the nineteenth and early twentieth centuries, therefore, may point to the political and social changes that led to the emergence of the modern notion of heredity.



Bernd Gausemeier

Genealogical methods and ideas shaped not only the medical discourse about disease inheritance, but also a number of related developments in the late-nineteenth-century human sciences: concerns about the perils of inbreeding, fears about the decline of aristocratic or talented families, ideas about the evolution of “genius,” and the turn to kinship studies in anthropology. The most important aspect, however, was the interaction between amateur genealogy and medical family research that evolved around

1900—a fusion of interests that proved to be of pivotal importance for the rise of the eugenics movement and that generated the biopolitical vision to create genealogical surveys revealing the kinship structures and the hereditary composition of complete populations.



Pedigree of a family with high susceptibility to tuberculosis and cancer. Max von Gruber/Ernst Rüdin, Fortpflanzung, Vererbung, Rassenhygiene. Illustrierter Führer durch die Gruppe Rassenhygiene der Internationalen Hygiene-Ausstellung 1911 in Dresden, München 1911



Maria Kronfeldner

*Maria Kronfeldner* (Karl Schädler Postdoctoral Research Fellow)

**The Anthropological Concept of Culture in the Context of Evolutionary Debates**

Maria Kronfeldner investigates how the anthropological concept of cultural inheritance developed in the beginning of the twentieth century in the face of a changing

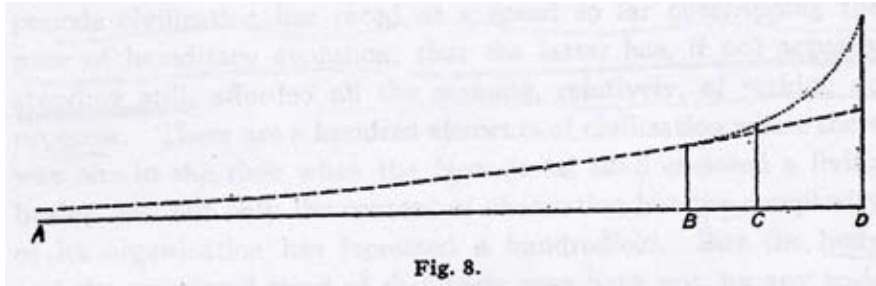
landscape of knowledge about evolution and heredity. Her main case study is on anthropology. When, in the beginning of the twentieth century, American anthropology was in the process of becoming an academic discipline, Alfred L. Kroeber (1876–1960) used Weismannian ideas about non-Lamarckian heredity (“hard inheritance”) to contrast it with a concept of cultural inheritance that he considered methodologically necessary for cultural anthropology.



Anthropologist Alfred L. Kroeber and Ishi, member of the Yahi tribe, 1911.

The concept of culture was for Kroeber a conceptual tool for the explanation of similarities and differences between people and groups of people; yet, in his hands it also became the very thing (beyond the visible similarities and differences) that cultural anthropologists seek to explain. (UC Berkeley, Phoebe Hearst Museum of Anthropology)

Kroeber not only created a gap between nature and nurture, but also an epistemic object—culture—that justified the existence of a new specialist for this object—the cultural anthropologist. Kroeber established culture as a separate entity by



With this graph, Kroeber intended to illustrate his cultural determinism, in which culture (dotted line) is a form of heredity, changing in an analogous and autonomous manner to biological heredity (dashed line) and physical persistence (continuous line).  
Kroeber, *The Superorganic*, 1917

claiming that its dynamic is independent of changes in biological inheritance. The case study not only explores how Kroeber developed his views, but also shows that the received view on the history of heredity wrongly assumes that Weismannism has only furthered hereditarianism, i.e., the belief that all human traits are explained by heredity. This view of Weismannism ignores that the development of the concept of hard inheritance (and the corresponding denial of Lamarckian inheritance of acquired characteristics) had a bi-directional historical effect. Far from ignoring non-hereditarian inheritance, by decoupling nature and nurture, it made room for cultural inheritance as a separate process, whereas previously cultural inheritance had been linked too closely to biological inheritance to have significance on its own.

Edna Suárez-Díaz (Visiting Scholar, Universidad Nacional Autónoma de México)

**Representation and the Construction of Knowledge in Molecular Evolution**

The aim of this project is to develop an analysis of the production and representation of knowledge in the field of molecular evolution from its beginnings in the early 1960s to the rise of bioinformatics and comparative genomics in the 1990s. The analysis takes place at three different levels. At the micro-level, molecular evolution offers a place to investigate the role of experiments and techniques in different scientific traditions and the ways in which they are connected with specific practices of representation. The goal is to extend a previous study in experimental traditions in nucleic acid hybridization to cover the role of electrophoresis in theoretical population genetics and the effects of protein and DNA sequencing on the construction of phylogenies and comparative genomics.



Edna Suárez-Díaz

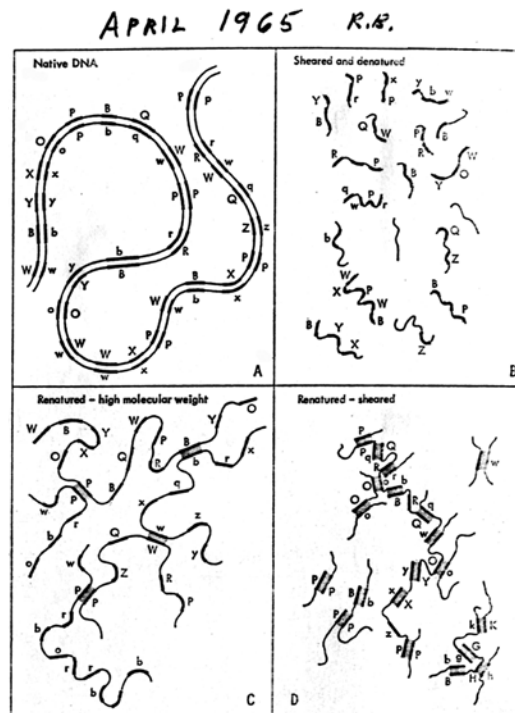


Diagram for Renaturation of DNA, with handwriting by Roy J. Britten. Yearly Report 1964, Carnegie Institution, Department of Terrestrial Magnetism, Biophysics, p. 318

At the disciplinary level, the project aims to offer an account of how the idea of informational molecules came to provide a powerful rhetoric for a new style of evolutionary study. By developing a new vocabulary, scientists such as Emile Zuckerkandl, Walter Fitch, and Roy Britten helped to create not only a linguistic convention, but a technical, social, and political frontier between the new molecular evolutionists and the “old” organismal evolutionists.

At a transdisciplinary level, molecular evolution has been constitutive in the development of the bioinformatics revolution. The elaboration of the first computer programs as early as 1966 for the construction of trees based on molecular data and the first databases on proteins illustrate this point. The project includes a study of the symbiosis between computer technology, bioinformatics, and genomics as a result of the Human Genome Project.

#### A Cultural History of Heredity

##### **Projects of the Short-term Guest Researchers**

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- *Carlos López Beltrán* (Universidad Nacional Autónoma de México): “The Influence of Biological and Medical Theories in Racial Classification of Humans.”
- *Jonathan Harwood* (Centre for the History of Science, Technology & Medicine, University of Manchester): “Europe’s Green Revolution: The Rise and Fall of Peasant-Friendly Plant-Breeding in Central Europe, 1890–1945.”
- *Staffan Müller-Wille* (ESRC Centre for Genomics in Society at the University of Exeter): “Heredity. History and Culture of a Concept.”
- *Manfred Laubichler* (School of Life Sciences, Arizona State University, Tempe, AZ): “Regulation and the Origin of Theoretical Biology.”

#### A Cultural History of Heredity

##### **Activities Related to the Project**

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###### **Research Collaborations**

In the context of this project, two research collaborations have been funded by the DAAD and the British Council and the Mexican Conacyt.

###### **The Gene and Its Legacy. Historical and Philosophical Issues in Genetics and Genomics**

MPIWG and ESRC Research Centre for Genomics in Society at the University of Exeter (DAAD/British Council, July 2005–August 2007)

This joint project was aimed at a historical and philosophical investigation of the processes of experimental research, data collection, and implementation of genetic knowledge that promote a gene-centered view in the life sciences and beyond. The collaboration included short research stays of visiting scholars, two one-day workshops in Exeter and Berlin, as well as jointly organized sessions at History of Science Society meetings and conferences of the International Society for the History, Philosophy and Social Studies of Biology.

### Evolution and Heredity: Genetics and Epigenetics

MPIWG and Universidad Nacional Autónoma de México (DAAD/Conacyt, January 2007–December 2008).

The intent of this project is to forge a close cooperation between the two research groups at the MPIWG and UNAM concerned with the history, philosophy, and sociology of hereditarian and evolutionary thinking from the second half of the nineteenth century up to the present time. The aim is to engage in a collective analysis of modern naturalistic thinking about nature, man, and society, to study cultural, national, and local differences, and to shape and provide the conceptual tools necessary to accomplish this goal. In addition, the project will enable a group of highly motivated doctoral and postdoctoral students to participate in the exchange program. In 2007, two German scholars (Maria Kronfeldner and Stefan Willer) traveled to Mexico City for research stays of three to four weeks at the UNAM campus. Two Mexican scholars (Ana Barahona and Sergio Martinez) and three Mexican PhD students (Erika Torrens, Vivette García and Fabrizio Guerrero) traveled to Berlin for research.

- Workshops

“Heredity in the Century of the Gene. A Cultural History of Heredity IV.”

Fourth international conference of the project, Exeter, December 11–14, 2006.

“Times of Cloning. Historical and Cultural Aspects of a Biotechnological Research Field.” International conference organized by Christina Brandt in collaboration with Giuseppe Testa (Branco Weiss Fellow “Society-in-Science”), Berlin, March, 1–4, 2007.

“Reproduction in the Century of the Gene.” One-day workshop, Berlin, March 30, 2006.

- Books

Hans-Jörg Rheinberger, *Epistemologie des Konkreten. Studien zur Geschichte der modernen Biologie*. Frankfurt am Main: Suhrkamp, 2006.

Staffan Müller-Wille and Hans-Jörg Rheinberger (eds.), *Heredity Produced: At the Crossroads of Biology, Politics, and Culture, 1500–1870*. Cambridge: MIT Press, 2007.

Edna Suárez-Díaz (ed.), *Variación Infinita: Ciencia y Representación, un Enfoque Histórico y Filosófico*. México: UNAM/Editorial Limusa, 2007.

- Upcoming events

“History of Plant Breeding Since 1880,” March 28–29, 2008, organized by Jonathan Harwood and Staffan Müller-Wille.

“Graphing Genes, Cells, and Embryos: Cultures of Seeing 3D and Beyond,” June 12–15, 2008, in collaboration with Sabine Brauckmann, Tartu University; Denis Thieffry, University of Marseille; and Gerd Müller, Konrad Lorenz Institute, Altenberg.

“Writing the History of Genomics,” October 29–November 1, 2008, organized by Edna Suárez-Díaz and Vincent Ramillon.

“Making Mutations: Objects, Practices, Contexts,” January 13–15, 2009, organized by Luis Campos, Alexander v. Schwerin, and Bernd Gausemeier.

Project

## Knowledge in the Making. Drawing and Writing as Research Techniques

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RESEARCH SCHOLARS *Christoph Hoffmann, Barbara Wittmann*

POSTDOCTORAL RESEARCH FELLOWS *Omar Nasim, Christof Windgätter*

COLLABORATIONS Research Group at the Kunsthistorisches Institut in Florenz:  
*Karin Krauthausen, Jutta Voorhoeve*

RESEARCH NETWORK Yale University (Rüdiger Campe); Hermann von Helmholtz-Zentrum für Kulturtechnik, Humboldt-Universität, Berlin (Werner Kogge); Technische Universität Berlin (Cornelia Ortlieb); Universität Wien (Wolfram Pichler and Wolfgang Pircher).

FUNDING Fritz Thyssen Stiftung, Max Planck Society (Strategic Innovation Fund), and MPIWG

### General Description of the Project

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“Knowledge in the Making” started as a research project in the fall of 2006. Since March 2007 it has been considerably enlarged into an inter-institutional research initiative of the Max Planck Institute for the History of Science in Berlin and the Kunsthistorisches Institut in Florenz (Max Planck Institute). Two working groups have been established that include four scholars in Berlin and two in Florence. Meetings of the project members take place every three months. The Florentine group focuses on the aesthetic and poetic power of drawing and writing in modern art and literature (1850–2000). Studies include “Paul Valéry’s *Cahiers* (1894–1945)—Drawing and Writing as a Practice of Thought” (Karin Krauthausen) and “Drawing in Contemporary Art: Notation, Expression, and Experiment” (Jutta Voorhoeve). For further details, see the report of the Kunsthistorisches Institut in Florenz.

The working group in Berlin has taken the recent interdisciplinary discussion on representational practices in the sciences as its starting point. Scientific representation is conceived as an active *process* that partly limits experience, partly enriches the observed phenomena, and partly enables completely new experiences. The manifold forms of “paper work” used in the context of scientific research are certainly no exception. Observational records and research notebooks filled with lists, tables, scribbles, and sketches constitute a genuine epistemic space from which knowledge emerges.

It is our main premise that the stylus—although a comparatively simple and apparently unsophisticated instrument—plays a decisive role in the production of knowledge. Many objects and phenomena become available and comprehensible only through drawn and written records. In particular cases, such as in psychology or pedagogy,



the production and analysis of drawings and written material become themselves a method of research. Stylus, pencil, and pen have the power to mediate. They translate observations into two-dimensional, and thus easily reproducible, texts and images; they concretize cognitive processes and in this way open up an interaction between perception and reflection, between the securing of phenomena and the formation of theses. In short, the activity of writing and drawing constitutes one of the most critical steps in scientific research: the step from preliminary and sometimes ambiguous data to stable facts.

Research on the function of drawing in modern science usually focuses on time spans in which stylus and paper provided the exclusive means for the fixation and reworking of research objects. Writing procedures in turn are mainly discussed in the narrow context of mathematical and chemical symbolism. However, with our project we want to emphasize that drawing and writing have maintained their ubiquitous presence and technical potential even within the complex and abstract cultures of modern science and scholarship. The target period—1800 to 2000—saw an intense competition between “old” and “new” media. Therefore the project will examine the tension between handwriting and drawing on the one hand and mechanical, photographic, and digital recording technologies on the other. The analysis of the various forms of their interaction will open up new perspectives on the relative utility of writing and drawing under the shifting epistemological and cultural conditions of modernity. Moreover, the epistemological approach of the project permits a direct comparison of the research methods of the natural sciences, the humanities, and the arts. We will deal with graphic recording techniques in the natural and human sciences within a broad context that embraces both artistic and technical recordings. Attentiveness to the simplest instruments of scientific observation will reveal parallels between the two cultures of inquiry, in particular concerning their common “techniques of creativity.”

## Knowledge in the Making Individual Projects

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*Christoph Hoffmann* (Research Scholar)

### Epistemic Writings

Analyzing the contribution of writing to the production of scientific knowledge begins with a shift of attention. Rather than using the multitude of papers that typically remain from scientific activities as a source for reconstructing particular processes, the focus is on them as monuments of writing practices.

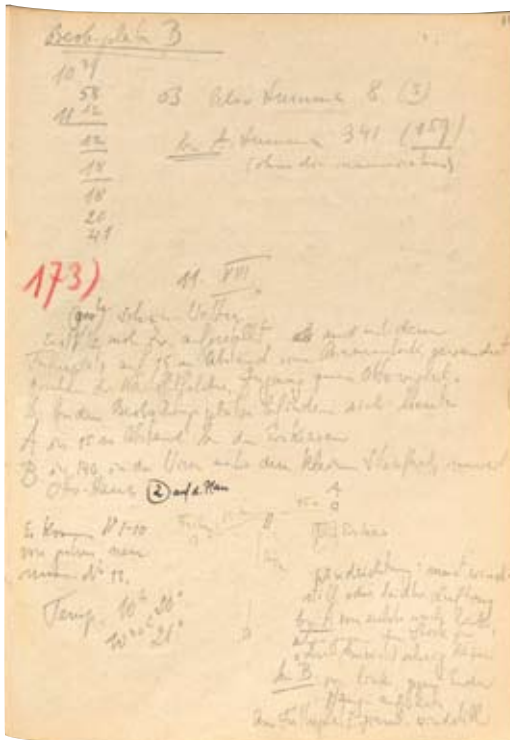
The major subject of the project is a study of notebooks and observational journals from the period between 1870 and 1950. It was in the late nineteenth century that division of labor and “mechanization” deeply altered the conditions of scientific practice. The notebook plays a double role in this respect: it is a means of administration and it offers a space for reworking the output of experiments and observations. The notebooks of the physicist and philosopher of science, Ernst Mach, provide a fasci-



Christoph  
Hoffmann

nating example of the diversity and richness of writing practices covered under the heading of keeping notes. One particular feature of Mach's notebooks is the combination of drawing and writing in the reworking of observational data and the development of theoretical approaches.

While Mach's notebooks represent a laboratory-based type of writing, the observational journals of the biologist Karl von Frisch provide access to the writing space of a field researcher from the 1940s. In those years, von Frisch was occupied with his studies on the dances of bees for which he received the Nobel Prize in 1973. Kept in a day-by-day format, his journals tell us that recording an experiment involves more than just writing down results. Notes or sketches showing the location of the beehives, remarks on the changing weather conditions, records of the behavior of individual bees—all formed a kind of diary both of the animals under observation and of the scientific observer.



A second part of the project deals with the records of post-mortem examinations. Here the aim is to reconstruct the function of writing as a recording technique in a particular scientific workplace. Of interest is the standardization of the writing process, the actual way in which the process is conducted, the use of forms, the teaching of writing down a protocol, the individual styles of recording, the evaluation and reworking of the records for scientific publications, and the changes that the regimen of recording experienced over the decades. Post-mortem records differ from many other scientific records in one major way: observers have to deal in the strictest sense with irreproducible phenomena. In most cases, only the record remains of the object under investigation.

Observational journal of Karl von Frisch.  
Bayerische Staatsbibliothek Munich,  
Manuscripts Division, August 1944



Barbara Wittmann

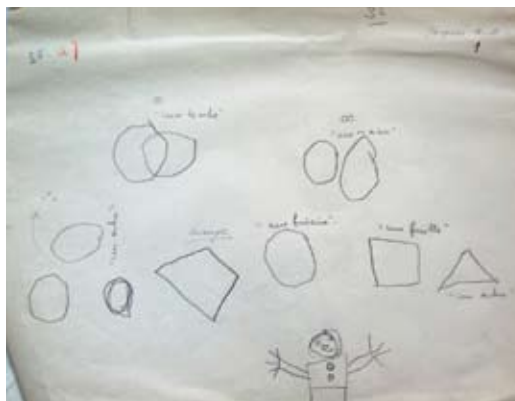
*Barbara Wittmann* (Research Scholar)

**Meaningful Scribbles. Children's Drawings as Psychological Instruments, 1880–1950**

The institutionalization of child psychology around 1900 was accompanied by techniques of observation and experiment that separated scientific attention from the education and everyday care of children. The experimental application and interpretation of children's drawings became one of those techniques. Whereas before 1880, children's drawings were seen as mere scribbles and not considered to be of any aesthetic or heuristic value, soon after psychologists and psychoanalysts such as James

Mark Baldwin, James Sully, William Stern, George-Henri Luquet, Karl Bühler, Melanie Klein, and Jean Piaget came to consider drawings to be a major diagnostic device in the investigation of children. Like children’s play and their stories, the “artistic production” was (and still is) believed to reveal sensomotoric functions and spatial perceptions, to give proof of children’s intelligence and social development, and to document their psychic disposition and etiology.

The emergence of children’s drawings as diagnostic tools was supported by different methods, techniques and tests that were developed to interpret what previously had been considered “meaningless.” These interpretative practices had to control the dynamics of drawing and the transference between the child and the scientist. The experimental set-ups and tests framed and stabilized the scribbles: certain qualities of children’s drawings were isolated; single gestures and motifs were repeated again and again. In this way, psychology began to conceive children’s drawings as a more or less orderly process through which the visualization of irregular psychic symptoms and dysfunctions was enabled. Children’s drawings were embedded and transformed into a calculated procedure that allowed the scientist to be surprised by unexpected phenomena.



Drawing of a 4 year old child (Jacques) from Jean Piaget’s experiments on the child’s conception of space. The Jean Piaget Archives, University of Geneva, around 1945

The operationalization of children’s drawings in psychology is certainly a special case in the history of drawing as a scientific instrument. Whereas all other kinds of scientific inscriptions are produced by scientists or commissioned artists, children’s drawings can only be made by the scientific object itself. Still, the drawings produced in experimental and diagnostic contexts should not be considered as immediate “self-portraits,” because they do not contribute to the constitution of subjectivity directly, but to its mediation and objectification. Thus, the historical reconstruction of the experimentalization of children’s drawings around 1900 promises to illuminate the practices and methods through which an everyday activity was transformed into a research technique and how it shifted between these functions.

*Omar W. Nasim* (Postdoctoral Research Fellow)

**Constructing the Heavens. Drawings of Nebulae in Victorian Science**

With the arrival of new and powerful telescopes came the development of sidereal astronomy, and thus a focused and increased interest in objects beyond our solar system. One of the central astronomical objects of this development was certainly the nebula. Many nineteenth-century astronomers spent much time, money, energy, and skill in understanding, observing, and cataloging these nebulae. A conspicuously distinctive feature of this effort was the mass of drawings of nebulae that were produced. While looking through giant telescopes, hundreds of preliminary and preparatory sketches were made in observing books, from which many detailed drawings were



Omar W. Nasim

made, sometimes with measurements and other times without. Selected figures were engraved and etched for publication in important scientific journals and astronomical catalogues. Some representative figures were further reproduced in popular works on astronomy. We are therefore confronted with an array of uses for these drawings: from the private everyday task of data gathering, to grand speculations related to the Nebular Hypothesis and the Plurality of Worlds thesis.

The project will examine the nature of these sketches and figures particularly in relation to the production of knowledge and the stabilization of ambiguous scientific objects. Particular emphasis is placed on the role played by the sketches as observational and research tools in the process of astronomical work done on nebulae. Much of the project's focus, therefore, will be dedicated to the day and night books, the ledgers, and the catalogues that were all prepared at various stages of astronomical research and observation. It is in these sources that one finds and is thereby able to track the various layers, forms, and processes of material development of the sketches of nebulae.



A large spiral shaped 'nebula.'  
Rough-sketch made by an assistant of the  
3rd Earl of Rosse. Birr Castle Archives, 1848



Christof  
Windgätter

*Christof Windgätter* (Postdoctoral Research Fellow)

**Typography of Knowledge. The Layout Policy of the Internationaler  
Psychoanalytischer Verlag (1919–1938)**

In our culture, the production, distribution and evaluation of printed texts is still a central aspect of science. Despite new technologies, a major part of our scientific memory is archived, managed, reworked, and handed down in the form of printed matter. Against this background, the project focuses on layout strategies as a missing subject in the history of science. Its aim is to examine the epistemic function of the design tools of print. The basic assumption is that books, journals, and other printed matter are neither merely reading objects nor just the multiple expressions of an author's intentions. Rather the graphic reality of printed texts influences and guides what can be understood through the act of reading. Typefaces, therefore, are regulations; their figurative appearance has to be considered as a condition of the constitution, mobilization, and socialization of scientific knowledge.

The particular perspective of this project is directed towards the Internationaler Psychoanalytischer Verlag (IPV), founded in 1919 in Vienna by a group around Sigmund Freud and shut down in 1938 by the Nazis. The IPV published all the titles of the contemporary psychoanalytical movement—Freud’s books starting in 1920, the first psychoanalytical dictionaries, the *Almanach*, the four leading journals as well as the first edition of Freud’s collected writings.

To investigate the IPV layout strategies, six areas of study will be considered, which together aim at an *epistemology of the IPV* and demonstrate that it introduced the practice of *corporate design* in the field of scientific publishing. The areas of study include the following: (1) The chronology of the IPV’s events, business affairs, and collaborations. (2) The naming politics of the IPV, delineate psychoanalysis. (3) The logo of the IPV, which was the Oedipus Vignette. (4) The color of the IPV books and journals, which, starting in 1924/25, were produced in yellow bindings or covers. (5) The typography of the books, for which the “Bernhard Modern” font was often conspicuously used. (6) The appearance of the shop windows for which the IPV books and journals were produced, ultimately represented the fundamental changes in product display and production processes in the publishing business around 1900.



Oedipus vignette.  
Internationaler Psychoanalytischer Verlag

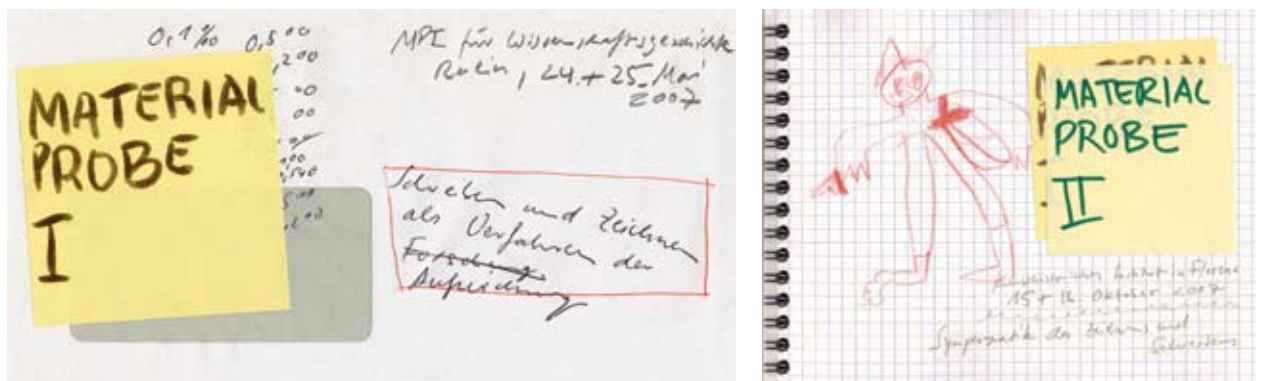
## Knowledge in the Making

### Activities Related to the Project

- Workshops

Materialprobe 1: “Datensicherung. Zeichnen und Schreiben als Verfahren der Aufzeichnung.” Workshop at the MPIWG, Berlin, May 23–24, 2007.

Materialprobe 2: “Symptomatik des Zeichnens und Schreibens.” Workshop at the Kunsthistorisches Institut in Florenz— Max Planck Institute, Florence, October 15–16, 2007.



Nachlese/Afterthoughts 1: “Vor dem ersten Strich/Before the First Line” (together with Wolfram Pichler, Universität Wien; Ralph Ubl, Committee on Social Thought, University of Chicago), Berlin, August 1, 2007.

- Upcoming events  
Seminar: “Logik des Verfahrens,” Wissenschaftskolleg zu Berlin, March 19, 2008.  
Nachlese/Afterthoughts 2: “Schreibszenen”/“Writing Scenes“ (with Rüdiger Campe, Yale University), MPIWG Berlin, June 10, 2008.  
Nachlese/Afterthoughts 3: “Kritzeln und Schnipseln”/ “Scrips and Scribbles” (with Hans-Jörg Rheinberger, MPIWG, Berlin), Kunsthistorisches Institut in Florenz—Max Planck Institute, Florence, July 17, 2008.  
Materialprobe 3: “Notes—Sketches—Scribbles: Writing and Drawing as Creative Tools,” Yale University, New Haven, November 13–15, 2008.  
Workshop: “Wissen im Druck. Zur Epistemologie der Buchgestaltung zwischen 1850 und 1950,” MPIWG Berlin, December 12, 2008.

### Project

## Generating Experimental Knowledge: Experimental Systems, Concept Formation, and the Pivotal Role of Error

RESEARCH SCHOLARS *Uljana Feest, Hans-Jörg Rheinberger*

POSTDOCTORAL RESEARCH FELLOW *Igal Dotan*

PREDOCTORAL FELLOW *Lambert Williams*

SHORT-TERM VISITING COLLABORATION PARTNER *Thomas Dohmen, Giora Hon, Jutta Schickore*

COLLABORATIONS Philosophy Department, University of Haifa (Giora Hon); Historisches Seminar, University of Wuppertal (Friedrich Steinle); Department of History and Philosophy of Science, Indiana University Bloomington (Jutta Schickore)

FUNDING German-Israeli Foundation, MPIWG

The project started in 2004, culminated in an international research conference in the summer of 2007 at the University of Wuppertal, and was completed in the fall of 2007. It consisted of two working groups, one was based at the University of Haifa (Giora Hon as principal investigator, Galina Granek as postdoctoral fellow, Thomas Dohmen as doctoral student), the other at the MPIWG in Berlin. The project was supported by the German-Israeli Foundation. To facilitate and implement exchange and cooperation among all group members, there were regular meetings, bringing together the groups at Haifa and Berlin, to discuss the progress of individual projects and relevant literature. Moreover, two workshops and a final conference were held at which the results of individual group members as well as the work of international scholars were presented.

## General Description of the Project

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Experimentation, a core procedure of modern science, has received new attention in the history and philosophy of science in the last two decades. While a wealth of new perspectives has opened up, one essential feature has remained largely unanalyzed—the very role of experiment as a *knowledge-generating* procedure. This was the starting point of our project, which aimed at developing a broader understanding of how knowledge is gained, shifted, and revised in experimental research. Three focal issues were explored: experimental systems, concept formation, and the pivotal role of error.

The experimental-systems perspective is informed by the work of Ludwik Fleck and others, who early on drew attention to the genesis of scientific facts, arguing that modern scientists, as a rule, do not deal with single experiments in the context of a clearly delineated theory. Experimental scientists deal with clusters of experiments that are usually not well defined and do not provide definitive answers. In an endlessly changing pattern, experimental systems combine elements that historians and philosophers of science have long sought to separate: research objects, theories, technical arrangements, and instruments as well as disciplinary, institutional, social, and cultural dispositions.

Recent studies have made clear that, to account for the epistemic variety in the details of experimental practice, one needs to differentiate several levels of conceptualization. Relying on certain instruments, procedures, and concepts that are taken as unproblematic is necessary for experimentation to succeed. At the same time, scientific activities and conceptualizations are constantly being attuned to each other as the experimental process unfolds. A specific type of experimentation becomes delineated when focusing on these processes: the exploratory experiment. It follows distinct guidelines and epistemic principles. In many cases, it leads to the revision of existing concepts and the formation of new concepts, which leads eventually to stability and the ability to express experimental results in more general terms.

A claim to knowledge within a certain system of research may be found in time—by various means—to be erroneous. But the variety of what “error” or, more generally, “going wrong” can mean is huge and has so far been studied only insufficiently from an epistemological perspective. This project built on the assumption that significant insight into the epistemic dynamics of experiment may be gained by asking what constitutes an error within an experiment. One is thereby directed away from the individual experiment to a broader system.

The individual projects pursued as part of this group each drew on one or more of the analytical frameworks outlined above.

## Generating Experimental Knowledge

**Individual Projects**

Igal Dotan

*Igal Dotan* (Postdoctoral Research Fellow)

**Natural Selection in the Lab: Background Knowledge and its Role in the Evolution of Experimental Systems**

In his project, Igal Dotan addressed the role played by background knowledge in the experimental generation of knowledge. Taking as a starting point various previous accounts of background knowledge (e.g., Popper, Bunge, and Aggassi), Dotan placed this issue in the theoretical context of Rheinberger's notion of the experimental system. Dotan focused particularly on the relationship between theoretical and experimental considerations in scientific research. He approached the issue with a detailed study of a particular branch of evolutionary genetics, namely, that which studies the process of aging by means of populations of fruit flies. Dotan produced several papers, some exploring theoretical aspects of this research, others focusing on experimental systems.



Uljana Feest

*Uljana Feest* (Research Scholar)

**Exploring Implicit Memory: On the Interrelation between Operationalizations, Concept Formation, and Experimental Artifacts**

Uljana Feest investigated the interrelation between concept formation and experimentation, using as a case study the emergence of a new research field within experimental cognitive psychology and cognitive neuropsychology. This field deals with a cluster of phenomena that are variously described as "implicit memory," "implicit learning," or "procedural knowledge." Hence, the emergence of this research field went hand in hand with the formation of a cluster of concepts. In Feest's project, special emphasis was placed on the concept of "implicit memory" and the experimental paradigms that are associated with the investigation of the phenomenon in question. The original thesis pursued in her project was the idea that operational definitions of concepts and operationalizations of research questions are central points of reference for the experimental investigation of the purported phenomenon. Feest is currently finishing a book manuscript that includes the case study about implicit memory.



Lambert Williams

*Lambert Williams* (Predoctoral Fellow)

**Complexity: 1960–2000**

The project of Lambert Williams examined the emergence and dispersion of the sciences of complexity from 1960 to the present. Particular emphasis was placed on the work done in "virtual experimentation," "experimental mathematics," and other trends in modeling and simulation technique. The project scrutinized how concrete knowledge claims spring out of an interwoven mesh of simulated entities, evolving technological arrangements, a sometimes less-than-seamless correspondence between theory and phenomenology, and so on. In his research, Williams not only provided some detailed investigations of the above contexts, but also reflected upon historiographical issues concerning the level at which to pitch a history of new disciplinary formations. Lambert Williams is currently finishing his dissertation at Harvard.



## Generating Experimental Knowledge

**Projects of Visiting Collaboration Partners**

*Thomas Dohmen* (Predoctoral Fellow, University of Haifa)

**Context and Error in the Epistemology of Scientific Experiment**

In his PhD project, Thomas Dohmen started out with the aim of evaluating how analyzes from recent contextualist epistemologies can be applied to philosophical issues that arise within the context of experimentation. His thesis—that the possibility of experimental error should lead to skeptical questions—was explored by means of a detailed historical and philosophical study of electron microscopy. Rather than addressing universal questions, his approach was to analyze the ways in which scientists and instrument makers attempt to optimize their instruments in their efforts to rule out all possible sources of artifacts. In the course of his research, Dohmen used and specified the notion of *comparison* as crucial to all attempts at calibration and validation. Dohmen presented several conference papers in the course of the project. He is currently completing his PhD dissertation.



Thomas Dohmen

## Generating Experimental Knowledge

**Activities Related to the Project**

- Workshops
  - “Error in Experimental Science.” Workshop organized by Giora Hon, Haifa, May 8–10, 2005.
  - “Generating Knowledge with Microscopes.” Workshop organized by Uljana Feest and Jutta Schickore, Berlin, June 23–26, 2006.
  - “Generating Experimental Knowledge.” International conference organized by Friedrich Steinle, Wuppertal, June 14–16, 2007.
- Books
  - Jutta Schickore and Friedrich Steinle (eds.), *Revisiting Discovery and Justification. Historical and Philosophical Perspectives on the Context Distinction*, Dordrecht: Springer 2006.
  - Giora Hon, Jutta Schickore, and Friedrich Steinle (eds.) (2008): *Going Amiss in Experimental Research*. Boston Studies in History and Philosophy of Science, Springer (forthcoming)

## Other Projects of the Department

### Senior Researchers

*Hans Erich Bödeker* (Research Scholar)

#### **Modern Natural Jurisprudence and the Social Sciences**

Hans Erich Bödeker's research project aims at a critical and empirically informed investigation of the emergence of the social sciences as a relatively distinct field. The modern natural-law discourse stands out among the European traditions of thought that helped to shape the social sciences. Its theoreticians provided the general theoretical framework for questions concerned with human nature, state and society, history, agency, wealth, and distant peoples. Emphasizing the natural-law tradition, the study suggests a quite different narrative from the traditional one for the rise of the social science discourse. The focus is on the intellectual developments of the German Enlightenment and its European context.

The investigation analyzes the general *problématique* of continuities and ruptures in the emergence of the social sciences. The interplay between the conceptual change and the contemporary macro societal context of state formation processes will also be brought to prominence. Such an inquiry into the rise of the social sciences brings together research areas such as the cultural history of the German Enlightenment, the history of the scholarly book, the history of scholarly practices (reading habits, traveling, observation, comparison, collecting), the history of political thought, and historical semantics, particularly *Begriffsgeschichte*.



Ursula Klein

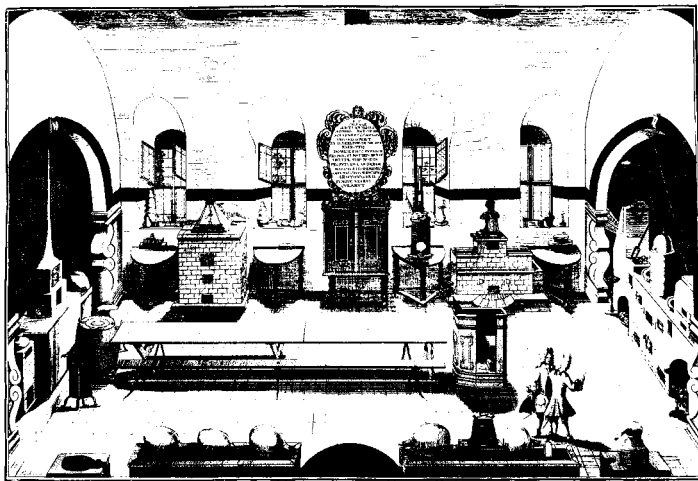
*Ursula Klein* (Research Scholar)

#### **Technoscience avant la lettre**

The systematic and stable interconnection of scientific and technological practices and institutions into a “technoscience” is usually considered to be a feature of the twentieth century, with forerunners in the second half of the nineteenth century. This project studies comparatively stable intersections of learned inquiries into nature and artisanal (or “technological”) practices in a much earlier period, namely from the late seventeenth until the early nineteenth century. In certain laboratories, innovative workshops, and specialist marketplaces of that period, artisanal skill and technical competence were combined with learned knowledge about nature derived from experience. Numerous university chairs, professional schools, economic and philosophical societies, academies, and journals were founded that fostered innovation in the practices of making, while simultaneously contributing to the scientific understanding of nature. Central to this project are forms of such advanced expertise at sites where commerce, practices of making, and learned natural knowledge intersected.

First results of the project have already been published, including the book (with Wolfgang Lefèvre, Department I) *Materials in Eighteenth-Century Science. A Histori-*

*cal Ontology* (Cambridge: MIT Press 2007) and an edited book manuscript (with E.C. Spary, Wellcome Institute, London) entitled *Between Market and Laboratory: Materials and Expertise in Early Modern Europe, 1500–1800* (currently under review for publication by MIT Press). The project continues further in two respects. It aims at a detailed description and analysis of intersecting practices of eighteenth-century German apothecaries, mining officials, assayers, and academic chemists, based on archival material as well as a large number of experimental reports published in the new professional journals of the period.



The laboratory of the University of Altdorf. Johann G. Puschner, *Amoenitates Altdorfinae oder eigentliche nach dem Leben gezeichnete Prospecten der löblichen Universität Altdorf [...]*. Nürnberg: Michahelle, ca. 1720 (Courtesy of the Niedersächsische Staats- und Universitätsbibliothek, Göttingen)

In addition to historical studies of concrete ways in which artisanal expertise and experimental inquiries into nature intersected, a second research strand studies issues concerning the history and philosophy of science and technology more broadly. These are (1) laboratories and their development from the late seventeenth until the middle of the nineteenth century, (2) styles of experimentation and their historical transformation, including a comparison of experimental history with experimental philosophy in the early modern period, and a comparison of experimental analysis in nineteenth-century chemistry, physics, and the life sciences, and (3) problems formulated under the auspices of an historical epistemology as compared to problems of a historical ontology.

*Carsten Reinhardt* (Visiting Scholar, University of Regensburg, now University of Bielefeld)

#### **Scientific Methods and Expertise, Nineteenth to Twentieth Centuries**

Carsten Reinhardt's work at the Institute concentrated on the history of scientific methods and expertise in the nineteenth and twentieth centuries. Successful claims of nineteenth-century scientists to represent nature in objective terms bolstered their status as legitimate experts. Furthermore, their ability to act—for example, to synthesize new (and useful) substances, to find hidden traces of precious (or dangerous) materials, to combat diseases—greatly amplified their impact. The potential of scientific methods determined the legitimacy and authority of scientific expertise. To be effective, methods had to be linked to societal demands. This process constitutes

the *longue durée* history of today's knowledge society postulated by sociologists. The project has been divided into three parts:

### 1 Science and the Law

In mid-nineteenth-century Germany, both analytical chemistry and the legal system underwent profound transformations. In court, chemical experiments and measurements supplemented and substituted other forms of expert opinion. The project attempted to determine how the evidence judged at the bar related to the evidence scrutinized at the bench.

### 2 Regulatory Science

The consequences of industrialization and the mass consumption of technical goods have been an issue since the late nineteenth century. In the 1960s, the focus changed from discrete domains to the environment at large. The project tried to reconstruct the social networking that both separated and connected science and policy and aimed to encircle the boundary objects involved.

### 3 The Meaning of Methods

The third part of the project tried to clarify the epistemic conditions, social structures, and historical phases of the making of methods in twentieth-century science. The phenomenon to be observed may be called inner-scientific expertise. Method-oriented scientists, for example, had a crucial impact on adapting physical methods to chemistry. For such scientists, methods were the final outcome of their work.



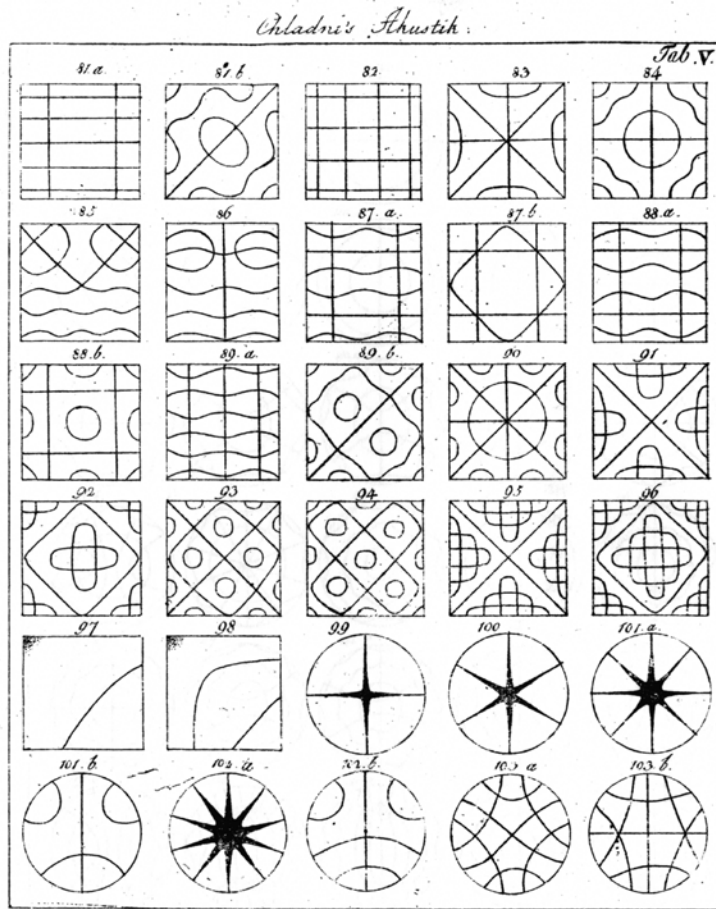
Laura Otis

*Laura Otis* (Visiting Scholar, Emory University, Alexander von Humboldt Fellow)

#### **Thinking with Images, Thinking with Words**

Some psychologists and literary scholars maintain that human thought is verbal by nature and that without language-based narratives, human identity would not even be possible. Others, from the arts as well as the natural sciences, insist that images are thoughts, offering their own experiences as evidence. Since examples of visual and verbal thinking are so often personal, both visually and verbally oriented individuals have had trouble convincing others of the validity of their thoughts. This project will bring together the insights and findings from a wide range of fields about the degree to which people think visually and verbally.

The foundation of this multi-disciplinary project is a historical study of late eighteenth- and early- to mid-nineteenth-century scientists who had overlapping interests in vision, sound, and language and who attempted to “translate” between sensory modalities, among them the German acoustician Ernst Chladni, the British inventor Charles Wheatstone, the British physicist Thomas Young, the British physician Peter Mark Roget, the British photographer Henry Fox Talbot, and the German physicist and physiologist Hermann von Helmholtz. Once this historical foundation is in place, the aim of the project will shift to a comparative reading of the latest findings and insights of neuroscientists, psychologists, philosophers, and literary scholars on the visual and verbal aspects of human thought. These findings will be supported and



Some of Ernst von Chladni's sound figures, created by sprinkling sand on a metal plate and stroking the edge with a violin bow.  
Ernst Florens Friedrich von Chladni,  
*Die Akustik*, Leipzig: 1802;  
Reprint, Hildesheim: Georg Olms, 2004

challenged by the results of interviews with people from a wide range of professions who identify themselves as visually or verbally oriented. Juxtaposing the findings of contemporary and past scientists with the claims of lay individuals, this project will question accepted notions of what counts as evidence and will reassess the epistemological value of anecdotes.

*Daniel Speich* (Visiting Scholar, Federal Institute of Technology, Zurich)

#### **Knowledge and Development. Technology and Science in the Postcolonial Culture of Development**

Since World War II, a complex system of international technical cooperation and development aid has evolved that prominently structures knowledge about the North-South divide. The history of the development business has been analyzed repeatedly by economists, historians, and political scientists who singled out political or moral motives of donors and, most importantly, dealt with the question of why aid so often failed. Daniel Speich's project follows a somewhat different line. It suggests understanding the aid industry as a new global culture within which forms of knowledge play a key role as agents of coherence. The main argument is that the internal cohesion of postcolonial development culture reached a critical dimension towards the end of the 1960s, allowing for system stability and growth despite rather unfavorable changes in the politico-economic environment. Three case studies describe the role



Daniel Speich

of scientific and technical knowledge in the perception of social change: an international organization (UNDP), a recipient country (Kenya), and a donor context (Switzerland).

The project aims at a historical reconstruction of the techniques through which economics came to shape the objects under scrutiny. Research during the stay at the Institute first focused on the gross domestic product (GDP) and other highly aggregate indicators of economic performance. A second line of inquiry was to ask to what extent economic research could be considered experimental. The project understands the shaping of the Kenyan national economy in the 1960s as an experimental practice in which modes of knowledge production and economic policy interventions were inextricably intertwined.

#### Other Projects of the Department

##### **Postdoctoral Fellows**

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Safia Azzouni

*Safia Azzouni* (Postdoctoral Research Fellow)

##### **The Popular Science Book: A New Genre between Literature and Science in the Late Nineteenth and Early Twentieth Centuries**

The project explored the emergence of popular science books in Europe during the second half of the nineteenth century and the role these books played in the transfer—and the production—of knowledge. Popular science was written not only by scientists, but also by professional popularizers. These authors—journalists, poets or former scientists—often had their background in two fields: science and literature.

Over the course of the nineteenth century, the interest poets took in scientific experimentation and innovation continuously increased. Scientific topics and methods influenced positivist literary theory and the naturalistic movement in France and Germany. Accordingly, the research project addressed the question of the extent to which the genesis of the popular science book was linked to the literary developments of the time.

Azzouni's project focused on exemplary case studies from the realm of German popular science writings. Among the writers dealt with were the theorist of naturalism Wilhelm Bölsche, one of the most famous German popularizers up to the 1930s, and the mathematician, physicist, and philosopher Kurd Laßwitz, one of the first German science-fiction authors. In addition, Azzouni investigated the part popularizers took in the philosophical debate over *Geisteswissenschaften* or *Kulturwissenschaften*.

- **Related Workshops**

“Dilettantismus als Beruf—Professional Dilettantism: Wissenschaft und Kultur im Spannungsfeld Experte—Laie.” Workshop organized together with Uwe Wirth, Zentrum für Literatur- und Kulturforschung (ZfL), Berlin, July 14–16, 2006

“Wissen für Alle! Popularisierung der Wissenschaften zwischen Belehrung, Manipulation und Aufklärung.” A public discussion between Andreas Daum (University at

Buffalo, SUNY), Jürgen Kaube (Frankfurter Allgemeine Zeitung), and Jürgen Renn (MPIWG), organized together with Milena Wazeck (Department I) in the context of “Das Jahr der Geisteswissenschaften,” Berlin, June 6, 2007.

*Didier Debaise* (Postdoctoral Research Fellow)

### **Constructing a Speculative Approach to Heredity on the Basis of Pierre Sonigo’s Work**

This project aimed at analyzing the reasons, the forms, and the effects of a radically Darwinistic position in contemporary French biology—in particular, the position of Pierre Sonigo and Pierre Kupiec. Kupiec and Sonigo wrote a very controversial book in 2000 called *Ni Dieu ni gène*, in which they tried to develop a new theory of heredity no longer based on the notion of information. They argued for coming back to a genuinely Darwinian model applied to all parts of the body, in particular to the cells. In their alternative model, notions such as “resource,” “variation,” “environment,” and “population” play a major role.

Didier Debaise’s research developed in three parts: In the first part, he compared this new form of Darwinism to Darwin’s own texts and followed the transformation of concepts such as “variation” and “population.” His main objective was to clarify what a “genuine” Darwinism could mean, and what kind of concepts and general orientations it requires. In the second part, he analyzed the specificity of Sonigo’s Darwinism as compared to other contemporary Darwinistic approaches, such as Richard Dawkins’s. The focus was on Sonigo’s claim that he was—in contrast to other neo-Darwinians—a non-reductionist. In the third part of his research, Debaise tried to link Sonigo’s approach to a tradition of philosophers including Alfred North Whitehead, Henri Bergson, and Gilbert Simondon who explicitly integrated Darwinian claims into theories of knowledge.

- Related Workshop

“Life and Societies. Toward a New Ecology of the Living.” MPIWG, November 2007

*Hyo Yoon Kang* (Postdoctoral Research Fellow)

### **Patent Classification and Scientific Taxonomies: Law as a Space of the History of Science?**

Hyo Yoon Kang’s project explores the interdisciplinary space between science and law, and more specifically, makes use of the relationship between scientific taxonomies and patent classification to examine the interaction between these two knowledge practices. Both are examples of practices of ordering and structuring information into manageable and more or less visible entities—entities that are made to relate to other entities through determinate variables and pathways. Although the International Patent Classification (IPC), administered by the World Intellectual Property Organization, is primarily a legal taxonomy by which technological and scientific inventions are hierarchically ordered, it also plays a central role in re-inscribing such objects’ intellectual and material properties by delimiting the scope of proprietary claims that can be made over them.



Didier Debaise



Hyo Yoon Kang

The aim of the project is to investigate—from the perspective of patent law—how the IPC simultaneously engages in defining and reconstructing a scientific object’s “intrinsic nature.” The project approaches the IPC as an epistemic tool that creates commodities (patents) by articulation of what constitutes the essence of a scientific object. From this perspective, the IPC and the practice of patent classification form an interface between a “legal history” of scientific objects and proprietary boundaries within the field of scientific practice itself. In other words, the IPC seemingly represents an unofficial site of scientific classification; however, it is a site engendered and negotiated by both science and law.



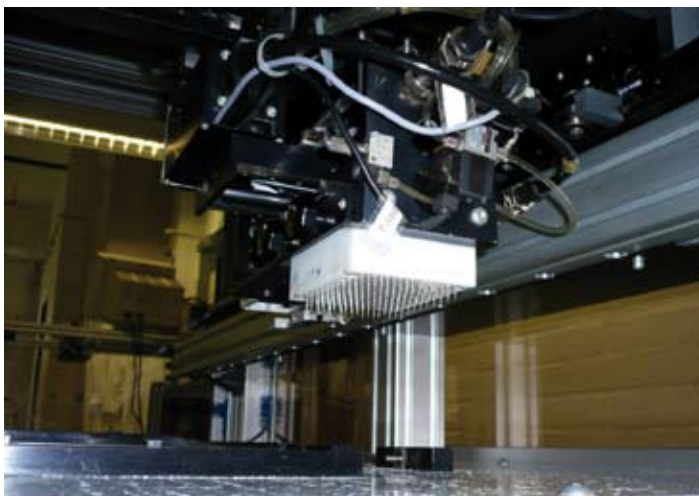
Vincent Ramillon

*Vincent Ramillon* (Postdoctoral Research Fellow)

### **The Material Culture of Genomics: Instruments, Organizations, and the Transformation of Knowledge Production**

This project targets the history of genomics by focusing on the material practices constitutive of this field of research and their relation to the transformations of the way research is organized. In particular, the automation of the mapping and sequencing procedures since the 1980s is of central interest to an understanding of the many reconfigurations observed in genomics. Automation imposed itself as a major topic for genomics in the very early discussions on the organization of large-scale sequencing projects around 1986–1988. The design and use of automata able to perform the various tasks required by sequencing, such as DNA library processing or sequence determination, rapidly became one of the most important fields of technological innovation applied to genomics.

Automation was understood as a means to replace human labor with machines apparently performing the same tasks. However, automation is never a mere process of replacement, and the use of these technologies engendered novel practices that shaped the field of genomics in many ways. Historically, the transformations throughout the 1990s can be read as emerging from the progressive differentiation of a managerial rationality and associated practices in the production centers and laboratory networks. Beyond these sociological transformations, the transfer of automation technologies



from sequencing to other types of experimental procedures has also played a critical role in the fabrication of novel experimental practices and the theoretical reconfigurations of molecular genetics in the second half of the 1990s, known first as “post-genomics” and “functional genomics,” and later theorized under the unified label of “systems biology.”

Clone-picking robot used at the Max Planck Institute for Molecular Genetics (Berlin) to process DNA libraries.



Olivier Thiery (Postdoctoral Research Fellow)

**History, Anthropology, and Philosophy of Neonatal Intensive Care and “Premature Babies”**

In the first year of his project, Olivier Thiery focused on the historical aspects of neonatal care. He looked into the history of scientific knowledge about premature babies, showing that they emerged as a distinct epistemic object only at the beginning of the second half of the twentieth century, when they started to be defined by their age and not, as in the past, by their weight. He also looked into the evolution of medical practices and technologies of intensive care in pediatrics from the end of the nineteenth century until today, from microcatheters to breathing machines, from specialized milks to pain management.



Olivier Thiery

The second year of work at the Institute was focused on anthropological and philosophical aspects of the medical practices around premature babies, based on ethnographic fieldwork conducted during four months in a French intensive care unit. The fieldwork consisted of a close observation of medical practices, habits, imitations or inventions, diagnoses, uses of machines, instruments, objects, examinations of the babies, relations with the parents, but also observation of the babies themselves. The philosophical questions basically concerned the links between what one could call the “modes of existence of the babies” and the “modes of action/passion” of the doctor and nurses. More than producing a simple description of the routines, acts, humans and non-human entities allowing the “fabrication of existence,” the idea was to focus on the situations of tension in which babies appear in the stream of action as a kind of immanent exteriority, a set of multiple and uncertain possibilities constraining the doctors and pushing them into a passive state of being.

Sophia Vackimes (Postdoctoral Research Fellow, History of Scientific Objects Network)

**The Genetically Engineered Body: A Cinematic Context**

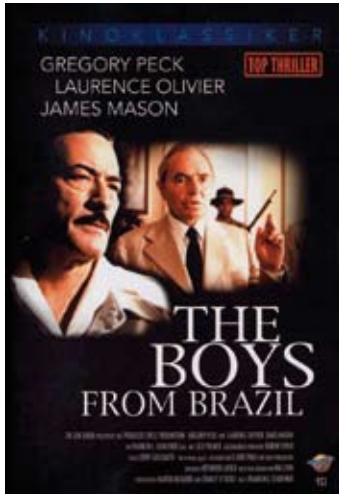
Contemporary research in the area of cloning has provoked intense media coverage and heated public discussion. Much of the controversy and debate surrounding research on cloning for both therapeutic and reproductive purposes revolves around the work performed in the creation and utilization of human embryos. The public has fearful perceptions of the work that scientists perform and is shocked by the moral and ethical implications of the technology. A recent survey by the Wellcome Trust confirmed that the public gets most of its information on science and technology from informal sources such as mass media; films are often quoted to express negative notions about science.



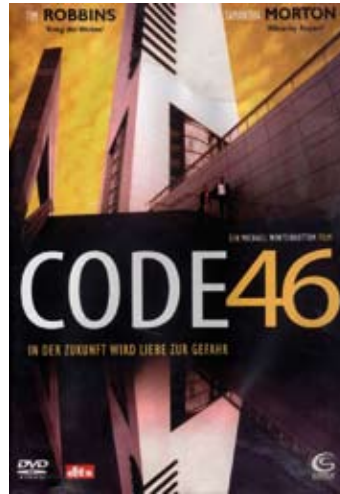
Sophia Vackimes

This study seeks to go beyond a facile condemnation of the cinematographic industry to give coherence to the various cultural elements that make up the content of films that in one way or another inform the public about genetics, cloning, and/or genetic engineering. Its purpose is to shed light on how films act as depositories of valuable cultural information/misinformation and how they might create consensus on the work of science. In analyzing *The Boys of Brazil*, Franklin J. Schaffner (1978); *The Island of Doctor Moreau*, John Frankenheimer (1996); *Gattaca*, Andrew Niccol (1997);

and *Code 46*, Michael Winterbottom (2003) among others, Sophia Vackimes lays out the elements that compose a spectacle where the ethical tensions of our time as well as the parameters of scientific work are played out.



Genetics and historical commentary are prominently put before large audiences. *The Boys From Brazil*, Schaffner, 1978



Oedipus and other great myths are transformed into critiques on scientific research. *Code 46*, Winterbottom, 2003



Evil science or research for the good of humanity: genetic experimentation. *The Island of Doctor Moreau*, Frankheimer, 1996



Christina Wessely

*Christina Wessely* (Postdoctoral Research Fellow)

**“Astronomy of the Invisible”: Cosmological *Weltanschauungen* around 1900.**

In 1886 the German engineer, inventor, and scientist Werner von Siemens announced the beginning of an “age of science” in Germany at a *Meeting of German Scientists and Medical Doctors*. National progress would be gained through the advancement of scientific knowledge, whereas pseudoscientific superstitions and prejudices would eventually die out as the powerful “light of science” superseded these “children of a former darkness.” Despite this vision of a modern society at the turn of the century, Germany and Austria would witness the rise of a large number of theories that hardly met Siemens’s previously expressed expectations for a new role of scientific knowledge. The Theory of the Hollow Earth (*Hohlweltlehre*), the Anti-Gravitation Doctrine (*Antigravitationslehre*), and the New Theory of Geocentricity (*Neue Geozentriklehre*) all offered spectacular images of the universe, insisting that the cosmos could not be fully understood through an exclusively rational approach, but necessitated intuition and fantasy as equally important foundations of scientific knowledge. Most of these new *Weltanschauungen* came in the shape of universal cosmogonies. Within only a few years, some of these theories became extremely popular and gained tens of thousands of enthusiastic adherents, despite strong rejection from academic scholars, who marked these theories as pseudoscientific fantasies.

The project deals with the social and political conditions that made the enormous success of these theories possible and inquires into the specific circumstances that led to this odd renaissance of cosmological *Weltanschauungen* in the first three decades of the twentieth century—a period of time that is commonly considered to be the age

of modern science. It takes the most popular of these ideas, the Cosmic Ice Theory (*Welteislehre*), as an example to show that these phenomena were not anachronistic, marginal ideas brought forward by some obscurantists but, rather, that these forms of “scientific esotericism” were an integral part of the discourse of modern science.

- Related Workshops

“No Guarantees. Innovative kulturwissenschaftliche Forschung unter unsicheren Bedingungen.” Workshop organized with Oliver Hochadel, Anton Holzer et al., *International Research Center for Cultural Studies/Vienna* (IFK) Vienna, April 27–30, 2006

“Pseudo-Wissenschaft. Konzeptionen von Nicht-Wissenschaftlichkeit in der Wissenschaftsgeschichte.” In cooperation with the DFG research focus “Science, Politics and the Public,” Department of History, Department of Contemporary History (University of Vienna). Vienna, November 29–December 2, 2006.

*Gábor Zemplén* (Visiting Guest Researcher, Budapest University of Technology and Economics)

#### **Experimentation and Scientific Debates**

Gábor Zemplén worked on a monograph on seventeenth-century debates about modificationist theories of color and Newton’s theory of light and colors. His work included the analysis and incorporation of novel theories of argumentation—especially the pragma-dialectical model developed by the Amsterdam school of argumentation—into the study of scientific controversies. He also published articles on the incorporation of the history of science into science education and in courses developing reflective judgment, and has developed modules for reconciling nature of science modules with social-constructivist approaches. Zemplén was also affiliated with the group “Generating Experimental Knowledge,” studying the use of experimental descriptions in scientific debates.



Gábor Zemplén

- Related Workshops

“Generating Knowledge with Microscopes.” Workshop organized with Uljana Feest and Jutta Schickore, Berlin, June 23–26, 2006.

“Kuhn and Relativism.” Workshop organized with Márta Fehér, Budapest, September 11–12, 2006.

## Short-term Visitors and Their Projects

- *Theodore Arabatzis* (Department of Philosophy and History of Science, University of Athens): “The Electron’s Hesitant Passage to Modernity, 1913–1925.”
- *Beat Bächi* (Institute for History, Federal Institute of Technology, Zurich): “Artificial Vitamin C. Roche and the Politics of a Chemical Body, 1933–1954.”
- *Bruno Belhoste* (Université de Paris 1 Panthéon-Sorbonne): “Paris as a Public Space of Science during the Late Enlightenment and the Romantic Age (1770–1840).”
- *Silvia Caianiello* (Istituto per la Storia del Pensiero Filosofico e Scientifico Moderno, CNR, Naples): “Modularity in Evolutionary Developmental Biology.”
- *Luis Campos* (History Department, Drew University): “Contemporary History of Synthetic Biology.”
- *Karine Chemla* (REHSEIS, CNRS & Université de Paris Diderot): “Epistemological Cultures.”
- *Tobias Cheung* (Humboldt University Berlin): “Agent Theories and Regulatory Models in the Life Sciences, 1900–1950.”
- *Moritz Epple* (Historisches Seminar, Johann Wolfgang Goethe University Frankfurt): “An Unusual Career between Cultural and Mathematical Modernism: Felix Hausdorff, 1868–1942.”
- *Ragnar Fjelland* (Center for the Study of the Sciences and the Humanities, University of Bergen): “Newton and Goethe on Reality and Scientific Method.”



Goethe's Color Circle. Goethe Museum Frankfurt, 1809

- *Jean-Paul Gaudillière* (CERMES, Paris): “History of the Industrial Uses of Biological Knowledge.”
- *Elodie Giroux* (Institut d’Histoire et de Philosophie des Sciences et des Techniques, Université de Paris 1 Panthéon-Sorbonne): “A Philosophical Inquiry into the Concepts of Health and Disease in the Context of Risk Factor Epidemiology.”
- *Thierry Hoquet* (Département de Philosophie, Université de Paris Ouest, Nanterre): “Darwin against Darwin? The Readings of *The Origin of Species*.”

- *Catherine Jackson* (University College London): “Analysis and Synthesis in Nineteenth-Century Organic Chemistry.”
- *Ilana Löwy* (CERMES, Paris): “History of Cancer Risk and Preventive Surgery for Feminine Cancers.”
- *Barbara Orland* (Center for History of Knowledge, Federal Institute of Technology and University of Zurich): “Economies of the Body. Transforming Knowledge Regimes on Nutrition and Regeneration from the Eighteenth to the Nineteenth Centuries”
- *Maria Rentetzi* (Department of Humanities, Social Sciences and Law, National Technical University of Athens): “Radium as a Trafficking Material.”



Left: The interior view of a radium emanatorium where patients are being treated with radon, designed by Radium Chemical Company Inc. in the 1920s



Right: Vita Radium Suppositories for men's sexual rejuvenation were produced by the Home Products Company of Denver around the 1930s, for confidentiality reasons shipped to costumers in a plain wrapper.

(Courtesy of Paul Frame, Health Physics Historical Instrumentation Collection, Oak Ridge Associated Universities)

- *Robyn Smith* (Carleton University, Ottawa): “Encountering Hermes in the Unknown: Exploring Experimental Vitamin Research during WWI.”
- *Benjamin Steininger* (Humboldt University Berlin, University of Vienna): “A Cultural History of the Concept of Catalysis in the First Half of the Twentieth Century.”
- *Viktoria Tkaczyk* (Free University of Berlin): “Unready to Take Off: Failed Flight Attempts in Early Modern Europe.”