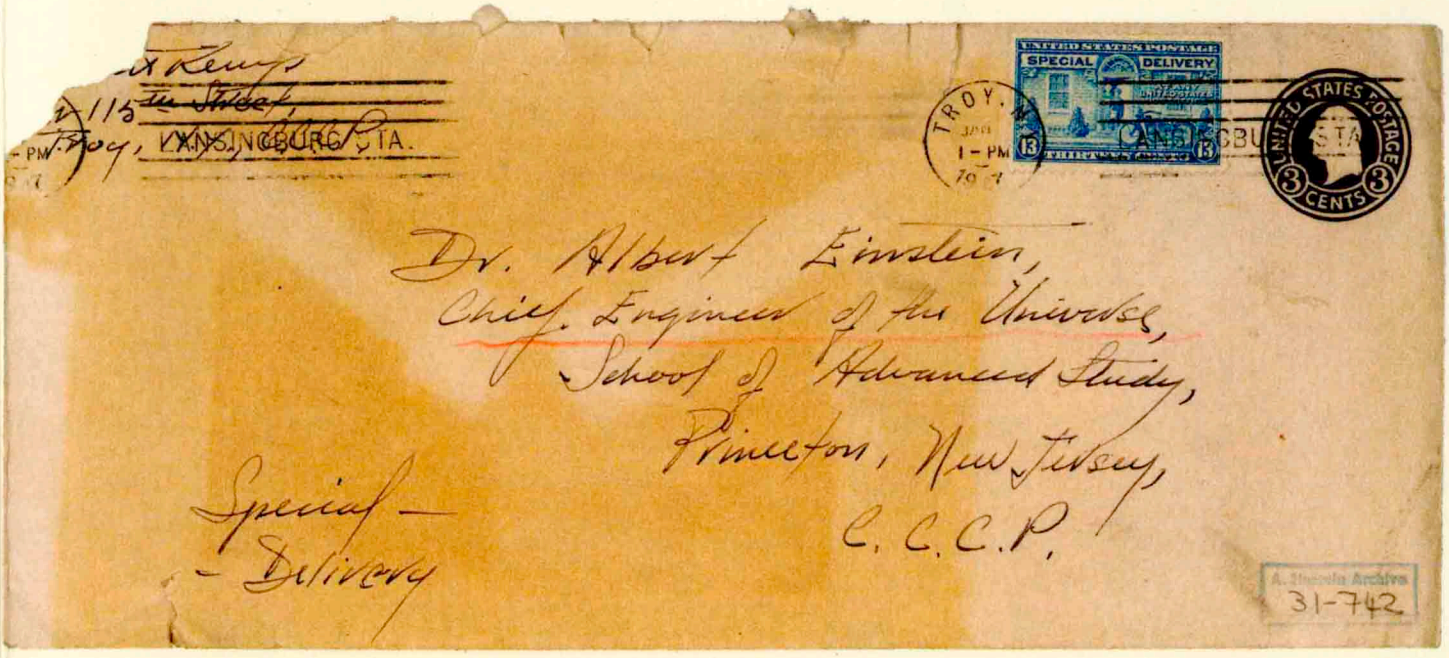


MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE

Max Planck Institute for the History of Science

RESEARCH REPORT 2004—2005

MAX-PLANCK-GESELLSCHAFT

Titel:
Envelope, addressed to Albert Einstein
„Chief Engineer of the Universe".
The Hebrew University, Jewish National &
University Library, Albert Einstein Archives,
Jerusalem, Israel, E. A. 031–742

Rückseite:
The entrance of the Institute's new building.
Architects: Dietrich Dietrich, Stuttgart

Most of the portrait photographs were done
by Skúli Sigurdsson, Berlin/Reykjavík

MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE

Max Planck Institute for the History of Science

RESEARCH REPORT 2004—2005

Introduction

Modern societies are saturated with science and technology. Spatial patterns—whether high-rise clusters or low-rise sprawls—and temporal rhythms, ever accelerating, reveal how profoundly science and technology have influenced the very framework of modernity. These influences penetrate deep into the realm of meaning as well as that of matter. The prestissimo pace of scientific innovation challenges citizens and leaders of modern polities to reform, create, or scrap values and institutions in order to integrate (or reject) the new possibilities. The understanding of what counts as knowledge, of truth itself, has been shaped not only by the results, but also by the historical development of the sciences.

The Max Planck Institute for the History of Science (MPIWG) studies this development in breadth and depth. Its research projects span ancient Babylonian mathematics and the human genome project, the rise of the twentieth-century neurosciences and the decline of Renaissance chronologies. Many projects are comparative, both historically and cross-culturally: for example, *longue durée* studies of mechanics from classical Greek and Roman antiquity to quantum mechanics, embracing not only learned treatises but also the practical knowledge crystallized in Italian fortifications and traditional Chinese market balances. The sources consulted for these projects include not only texts and images, but also objects; the forms of publication have expanded from books and articles to embrace websites like the Virtual Laboratory, films like "Visualizing Science at Work: C.T.R. Wilson's Cloud Chamber Experiment", and museum exhibitions like "Einstein: Chief Engineer of the Universe" as well.

The common thread running through these diverse projects is a thoroughgoing awareness of the historicity of science, the concomitant of the restless process of innovation. The historical character of science (understood in its widest and least anachronistic sense as any body of systematic knowledge) emerges at multiple levels: most obviously at the level of empirical findings and changing theories, but also at the level of which objects are selected for scientific inquiry and how they are investigated and explained. That is, the ontology and the epistemology of the sciences change over time, often dramatically. New forms of inquiry, such as experiment and observation, categories of explanation, such as cause and correlation, and epistemic

virtues, such as objectivity and certainty, are invented and refined. So are new objects, such as the chemical element and the gene, and new personae, such as the naturalist and the experimenter.

All of these novelties appear in a specific historical context, a particular time and place, and often build upon local resources of knowledge and skill: for example, early modern chemists drew upon the classifications of materials devised by apothecaries, metal workers, and other craftsmen. Yet scientific and technological innovations also spread: local knowledge becomes universal knowledge. Both moments of scientific change, emergence and diffusion, are fundamental to the research conducted at the MPIWG.

Because current scientific disciplines are themselves products of these historical processes, most research at the MPIWG is not organized along disciplinary lines. Although several research projects are concerned with changing classifications of knowledge, contemporary divisions like those between the natural and human sciences, or between the laboratory and field sciences, are more likely to be the objects rather than the presuppositions of historical investigation. Instead, research is generally structured by over-arching categories like "deduction" or "experiment", rather than the "history of physics" or the "history of biology". Moreover, knowledge is understood ecumenically, to embrace, for example, the know-how of engineers as well as the demonstrations of mathematicians. Depending on period and problem, the relevant historical context expands and contracts.

Research is the core activity of the MPIWG. But 2004—5 have been eventful years for Institute in other respects as well. In 2005 scholars in Department I made signal contributions to the events of the Einstein Year, especially the remarkable exhibition that officially opened on May 12 in Berlin. Also in 2005, the Institute's new building in Dahlem (see back cover), designed by the Stuttgart architects Dietrich + Dietrich, was completed (we moved in February 2006). A proposal for a five-year Max Planck Society Research Network on "The History of Scientific Objects" was approved; the organizational meeting of the international network of cooperating institutions (from Germany, France, Italy, the United Kingdom, and the U.S.A.) took place at the MPIWG in September 2005. With the help of the Max Planck Society and the MPIWG Board of Trustees, negotiations were begun with the Freie Universität Berlin and the Humboldt-Universität zu Berlin to create new professorships and independent junior research groups in the history of science, thereby formalizing and strengthening the MPIWG's links with neighboring universities.

In 2004, the MPIWG celebrated its tenth anniversary, but amidst all the happy changes of the past two years covered by this report, we feel that we have been given the opportunity to begin afresh. This would not have been possible without the wise counsel of our Scientific Advisory Board, the generous support of the Max Planck Society and other funding organizations, the good cheer and efficiency of our staff, and, above all, the intellectual stimulation of the scholars young and old, from near and far, who keep the Institute buzzing. We thank all most heartily.

Lorraine Daston
July 2006

Table of Contents

Structure and Organization of the Institute

Scientific Advisory Board

Prof. Dr. Janet Browne, The Wellcome Trust, Centre for the History of Medicine at University College London, U. K.
Prof. Dr. Moritz Epple, Historisches Seminar, Johann Wolfgang Goethe-Universität, Frankfurt am Main, Germany
Prof. Dr. Paula E. Findlen, History Department, Stanford University, U.S.A.
Prof. Dr. Peter Galison, Department of the History of Science, Harvard University, Cambridge, U.S.A.
Prof. Dr. Paolo Galluzzi, Istituto e Museo di Storia della Scienza, Florence, Italy
Prof. Dr. Peter Hammerstein, Fachinstitut Theoretische Biologie, Humboldt-Universität zu Berlin, Germany
Prof. Dr. Ilana Löwy, l'Institut Fédératif de Recherche IFR 69, Villejuif, France
Prof. Dr. Christoph Meinel, Lehrstuhl für Wissenschaftsgeschichte, Universität Regensburg, Germany
Prof. Dr. Jakob Tanner, Historisches Seminar, Universität Zürich, Switzerland
Prof. Dr. Helmuth Trischler, Deutsches Museum, München, Germany
Prof. Dr. M. Norton Wise, Department of History, University of California, Los Angeles, U.S.A.

Board of Trustees

Prof. Dr. Wolfgang Schieder (Chair), Universität zu Köln, Germany
Prof. Monika Grütters (Vice Chair), Member of the German Bundestag
Hans Werner Kilz, Editor-in-chief, Süddeutsche Zeitung
Prof. Dr. Dieter Lenzen, President of the Freie Universität Berlin, Germany
Prof. Dr. Christoph Markschies, President of the Humboldt-Universität zu Berlin, Germany
Thedel v. Wallmoden, Director of the Wallstein Verlag, Göttingen, Germany
Ranga Yogeshwar, Head of the Science Department, Westdeutscher Rundfunk Köln, Germany

Departments and Research Groups

Department I: Structural Changes in Systems of Knowledge

Prof. Dr. Jürgen Renn

DIRECTOR *Prof. Dr. Jürgen Renn*

RESEARCH SCHOLARS *Dr. Peter Beurton, Dr. Katja Bödeker, Dr. des. Ing. Claudia Bührig* (until May 2005), *Jochen Büttner, Giuseppe Castagnetti, PD Dr. Peter Damerow, Brian Fuchs, Prof. Dr. Dieter Hoffmann, Dr. Malcolm Hyman, Dr. Horst Kant, Dietmar Kurapkat, Prof. Dr. Wolfgang Lefèvre, Dr. Christoph Lehner, Dr. Jürgen Neffe* (until June 2004), *Dr. Albert Presas i Puig, Simone Rieger, Matthias Schemmel, Markus Schnöpf* (until February 2005), *Dr. Volkmar Schüller, Matteo Valleriani, Milena Wazeck*

Department II: Ideals and Practices of Rationality

Prof. Dr. Lorraine Daston

DIRECTOR *Prof. Dr. Lorraine Daston*

RESEARCH SCHOLARS *Dr. Mechthid Fend, Dr. Anke te Heesen, Dr. Bernhard Kleeberg, Dr. Christine von Oertzen, PD Dr. Fernando Vidal, Dr. Annette Vogt, Dr. Kelley E. Wilder*

Department III: Experimental Systems and Spaces of Knowledge

Prof. Dr. Hans-Jörg Rheinberger

DIRECTOR *Prof. Dr. Hans-Jörg Rheinberger*

RESEARCH SCHOLARS *Dr. Christina Brandt* (since February 2006: Senior Research Scientist), *PD Dr. Sven Dierig, Dr. Uljana Feest, Dr. Peter Geimer* (until March 2004), *PD Dr. Christoph Hoffmann, Dr. Julia Kursell, Dr. Staffan Müller-Wille* (until September 2004), *Dr. Henning Schmidgen, Prof. Dr. Friedrich Steinle* (until August 2004)

Independent Research Group I (January 1999–December 2004): History and Philosophy of Laboratory Sciences

DIRECTOR *PD Dr. Ursula Klein*

PD Dr.
Ursula Klein

Independent Research Group II (April 1999–February 2007): Experimental History of Science

DIRECTOR *PD Dr. H. Otto Sibum*

RESEARCH SCHOLAR *Annik Pietsch*

PD Dr.
H. Otto Sibum

Service Units

Administration headed by *Claudia Paaß*
Library headed by *Urs Schoepflin*
Information Technology headed by *Dirk Wintergrün*
Research Coordination *Jochen Schneider*

Claudia Paaß

Urs Schoepflin

Dirk Wintergrün

Jochen Schneider

The new Independent Research Group "From Invention to Innovation. Cultural Traditions of Technical Development in China," headed bei PD Dr. Dagmar Schäfer, will start its work by October 2006.

From left to right, back rows:
Paul Trzeciok, Anna Holterhof,
Peter Damerow, Lindy Divarci,
Matteo Valleriani, Sadiye Leather-Barrow.

Middle row:
Massimiliano Badino, Daniela Monaldi,
Dietmar Kurapkat, Miriam Gabriel,
Brian Fuchs, Simone Rieger,
Peter McLaughlin, Carmen Hammer,
Dieter Hoffmann, Giuseppe Castagnetti.

Front row:
Jürgen Renn, Malcolm Hyman,
Ulrike Fauerbach, Christoph Lehner,
Wilhelm Osthues.

Department I

Structural Changes in Systems of Knowledge

Director: *Jürgen Renn*

The work of the research group headed by Jürgen Renn is mainly dedicated to understanding the historical processes of structural changes in systems of knowledge. This goal comprises the reconstruction of central cognitive structures of scientific thinking, the study of the dependence of these structures on their experiential basis and on their cultural conditions, and the study of the interaction between individual thinking and institutionalized systems of knowledge. This theoretical program of an historical epistemology is the common core of the different investigations and research projects pursued and planned by the research group.
In order to cover at least some of the major developmental steps in the history of science, research is pursued in four different areas: the emergence of formal sciences such as mathematics; the emergence of empirical sciences such as physics, chemistry, and biology; structural changes in sciences with developed disciplinary structures and integrated theoretical foundations, such as the transition from classical to modern physics; and the role of reflective thinking and second-order concepts in science.

Present research in these areas focuses on four central projects:

1. the relation of practical experience and conceptual structures in the emergence of science,
2. reorganizing knowledge in developed science,
3. the long-term history of the unwritten knowledge that has made the great architectural achievements of mankind possible, and
4. transfer and transformation processes of knowledge across different cultures.

The first project seeks to understand the emergence of fundamental concepts of empirical science arising from the reflection of practical experiences, prior to the period in which experiments became the dominating experiential basis of science.
The second project studies processes of knowledge organization, focusing on the rise and decline of the mechanical worldview.
The third project deals with an epistemic history of architecture and analyzes the knowledge implicit in actions that emerged long before the advent of science, and that was repeatedly subjected to transformations that explain the fascinating interplay of utility, rationality, and art that is the hallmark of architecture.

Dancing with Gravity. L. Taudin

The fourth project, which has just been awarded a major grant by the Strategic Innovation Fund of the Max Planck Society (MPG), focuses on the conditions, pathways, and consequences of globalization processes of knowledge, relating them to present processes of globalization, in particular those involving the development of the Internet and the global organization of science.

Two further areas of work belong to what may be called "history of science in action." One of these areas of activities is dedicated to developing advanced tools for an historical epistemology. In this area, new electronic media are used and developed—in close co-operation with the IT-group of the Institute—to explore innovative ways of creating access to the empirical basis of the history of science. Central to the second area was a major effort to realize new forms of combining scholarly communication with a public outreach of the history of science, mainly in the context of the exhibition "Albert Einstein: Chief Engineer of the Universe."

During the period covered by this research report, several goals of these projects have been reached and new targets have been set. In the context of the first project, focusing on the development of mechanical knowledge, the acquisition, analysis, and commentary of a substantial part of the relevant primary sources has been accomplished and significant dissertation projects have been completed. The joint work with the Partner Group at the Institute for the History of Natural Sciences of the Chinese Academy of Sciences in Beijing has yielded contributions to the reconstruction of the long-range development of mechanical thinking in China and to the understanding of the interaction between western scientific knowledge and that of the Chinese tradition.

As the research projects of the department have to integrate knowledge from a wide range of disciplines, cultures, and historical periods, they are realized in co-operative networks extending well beyond the boundaries of the Institute. The Institute typically represents, however, a central node of such networks, bringing together scholars to form teams characterized by intense co-operation over longer periods of times. The challenges of cross-cultural comparisons, diachronic studies of historical developments, and the close integration of computer-assisted source analysis and scholarly interpretations are addressed with the help of a combination of core teams, who bear the main responsibility for a project and an array of informal working groups which are often independently funded, characteristically shaped by the interests of younger scholars and connected by weaker or stronger links to the activities of the core team. Exploring and validating theoretical conclusions with reference to the vast collection

of primary sources, but also building upon the existing scholarly literature would be inconceivable without the help and active participation of the Institute's library and information management facilities built up with the support of the IT-group.
It has been possible to substantially expand the ongoing investigations in the context of the first project by complementary projects funded by third-party resources. Since January 2005, the department participates in the DFG Collaborative Research Center (SFB) *Transformations of Antiquity*, which brings together ten humanities disciplines from the Humboldt University in Berlin, two subjects from the Freie Universität Berlin, and the Max Planck Institute for the History of Science (MPIWG) to collaborate in sixteen projects with around fifty academic researchers from six different faculties altogether. The SFB concentrates on the transformation processes by which European cultures, arts, and sciences have formed themselves in a continuation of the cultures of antiquity. The work of the department in the framework of the SFB focuses on the sub-project "Weight, Energy and Force: Conceptual Structural Changes in Ancient Knowledge as a Result of its Transmission" (Malcolm Hyman, Matteo Valleriani).

Worldviews at the Einstein Exhibition.

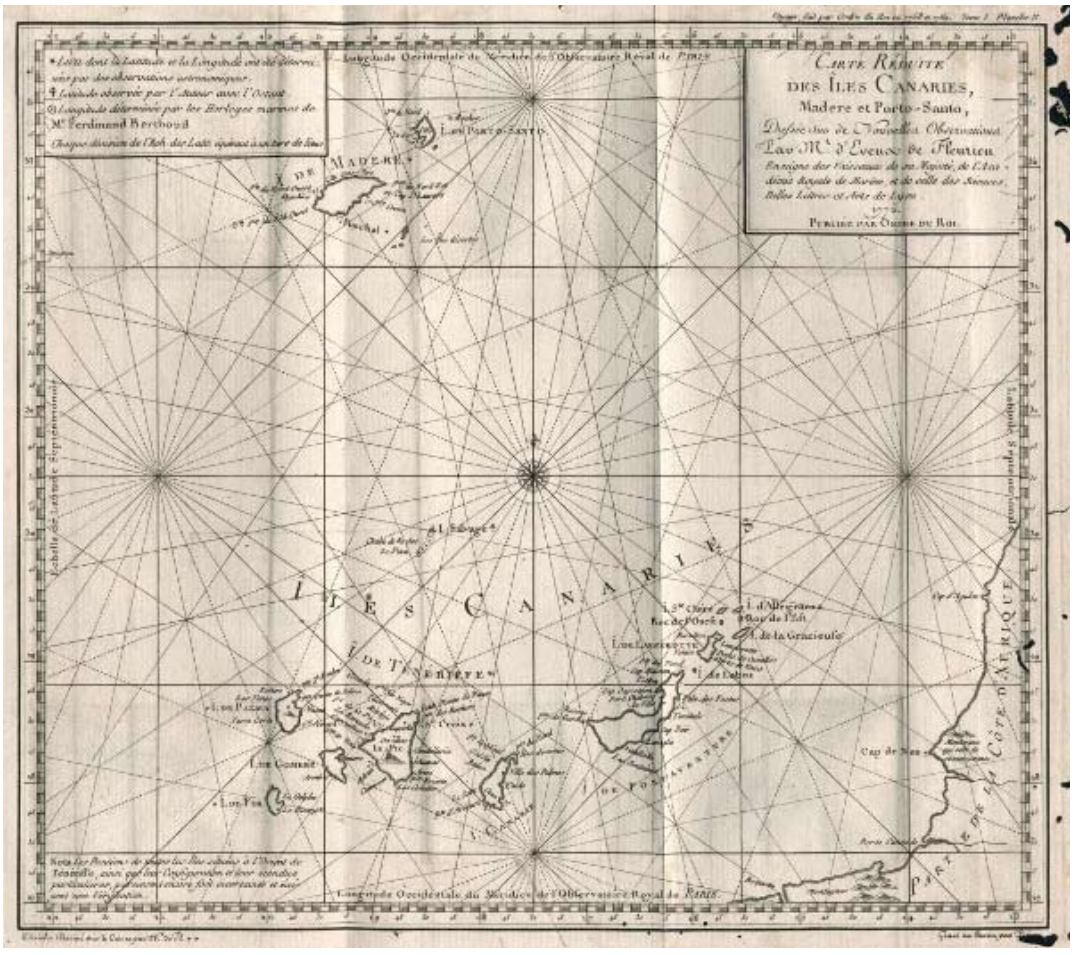
It has furthermore been possible to obtain a grant from the German-Israeli Foundation for Scientific Research and Development (G.I.F.) that partially funds a joint research project "Jesuits on Statics, Dynamics, Mathematics and Astronomy between Galileo and Newton." This project has been undertaken together with the Cohn Institute for History and Philosophy of Science and Ideas at Tel Aviv University to complement the study of an important aspect of the development of mechanical knowledge: the dissemination and transmission of scientific knowledge in the early modern period through the highly developed communicative network of Jesuit colleges and universities (Jochen Büttner, Peter Damerow, Rivka Feldhay).
A central part of the second project, focusing on the relativity revolution, has been brought to a close. The four-volume series *The Genesis of General Relativity*, comprising over 2000 pages and presenting the comprehensive results of this part of the project, have been prepared for publication at the Institute and are now in press. Work on these volumes has been complemented by several other activities, including the Internet publication of key primary sources relevant to the relativity revolution, the organization of a major international conference on the history of general relativity,

and work on a dissertation project on the opposition to the theory of relativity in the broader public in the 1920s.

Preparations to extend the reconstruction of the conceptual revolution of modern physics to the case of the quantum theory with the aim to similarly trace its roots in the developments of classical science have been further pursued. They have led to initial results, which are being prepared for publication, as well as to the formation of an extensive worldwide network of collaborations—involving both physicists and historians of science. In particular, a joint project proposal together with the Fritz Haber Institute of the MPG to the Strategic Innovation Fund of the President of the Society concerning the history of quantum mechanics has just been granted.

In the context of the third project, dedicated to the epistemic history of architecture, undertaken jointly with the Bibliotheca Hertziana (Max Planck Institute for the History of Art) in Rome and funded by a special grant from the MPG, a number of conferences and workshops have taken place and several publications prepared. In addition, an exhibition project on the Hagia Sophia has been realized and numerous primary sources relevant to the project published on the Internet. These achievements were possible despite the difficulties that arose when the project head from the MPIWG left the department to take up a permanent position.

Preparations for the fourth project, dealing with the globalization processes of knowledge, have just begun during the period of this research report. It aims at integrating



Voyage fait par ordre du roi en 1768 et 1769 à différentes parties du monde pour éprouver en mer les horloges marines ...
Ferdinand d'Eveux, 1773

various activities under a common thematic umbrella that have so far been undertaken in isolation, or under a more technical perspective. Research on the invention of writing and the emergence of mathematical thinking in ancient Babylonia that has been pursued since the foundation of the Institute is now increasingly being brought into contact with the study of parallel processes in other cultures, such as China, India, and the New World. Research on European scientific expeditions that sailed to America, Africa, the Pacific and Indian Oceans, as has been undertaken in the context of the Humboldt project (a joint project with the Fundación Canaria Orotava de Historia de la Ciencia, funded by the Government of the Autonomous Region of the Canary Islands), is being redirected to analyze the conditions, structures, and consequences of transatlantic knowledge transfer in colonial and post-colonial times <http://humboldt.mpiwg-berlin.mpg.de/>.

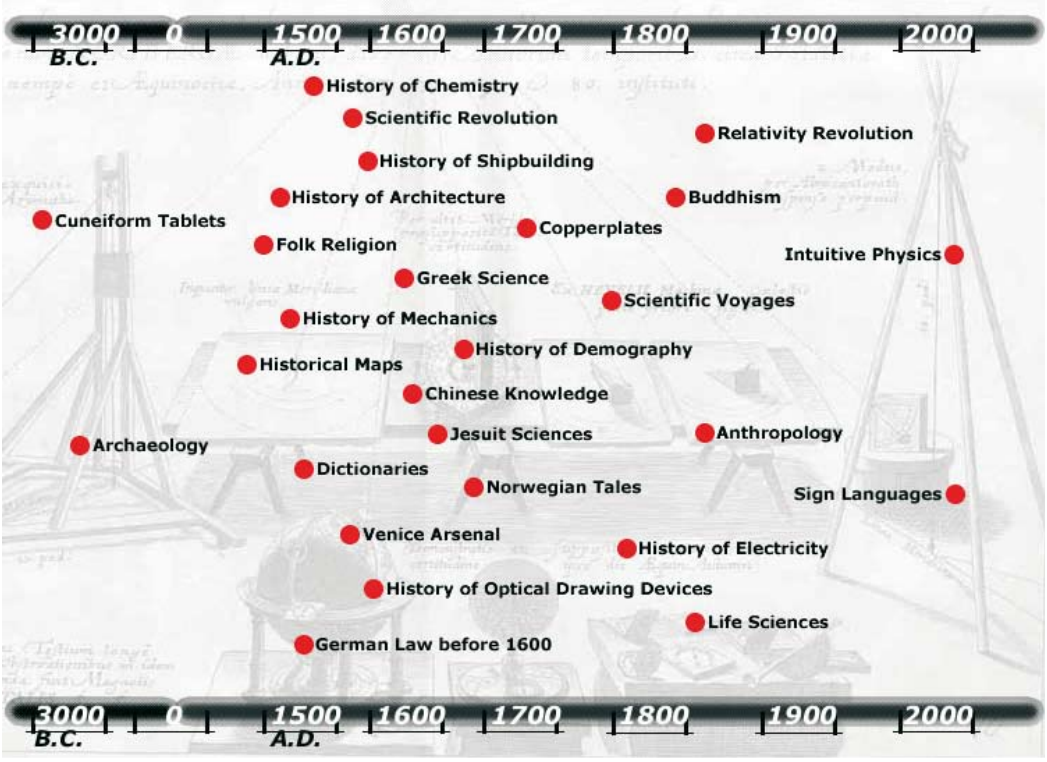
All central research activities of the department draw heavily on the potential of the new media and hence require new forms of integrating scholarly with technical competence. The reliance on access to large corpora of sources also requires strategic alliances with holders of sources such as libraries and archives. The Cuneiform Digital Library Initiative (CDLI), a pioneering endeavor launched in 2000 by the Institute together with the University of California at Los Angeles, with support from the US National Science Foundation (NSF), has therefore not only introduced advanced techniques of electronic information management into scholarly work, but has also created an international network of research institutions, universities, and museums with the aim to virtually rejoin and analyze cuneiform archives now scattered in numerous museum collections (Jacob Dahl, Peter Damerow, Robert Englund) <http://cdli.ucla.edu>. In a similar way, the Archimedes Project (see below), originally funded by a major grant received from the NSF and the Deutsche Forschungsgemeinschaft, has enabled the historical reconstruction of mechanical knowledge—central to the first project—to be addressed in a much more systematic way than was previously possible. Such projects are part of a fundamental restructuring of scholarly work in the humanities and demand flexible structures of research, innovative institutional infrastructures, and also the support of creative science policies in overcoming the resistance of traditional working modes. In the period under consideration, these projects took a new direction. Whereas previously they had concentrated on acquiring data such as digital images and transcriptions and on developing tools for presentation and mark-up, they turned more and more from data-acquisition to content-curation and content-enrichment, and to the development and exploitation of language technology for semantic access and analysis.

The experiences of pioneering ventures such as the Archimedes Project <http://archimedes.mpiwg-berlin.mpg.de> and the CDLI project, undertaken in the context of the scholarly work of the department, have provided the background for the creation of novel support structures for research information management at various institutional levels. The European Cultural Heritage Online (ECHO) initiative (coordinated by Simone Rieger) was launched in 2002 in collaboration with sixteen European partners, including two other Max Planck Institutes (Max Planck Institute for Psycholinguistics in Nijmegen and the Bibliotheca Hertziana in Rome) and funded by the European Commission. Its aim is to create an open-access infrastructure bringing cultural heritage online. In the period under consideration, ECHO significantly

extended, also with the help of a grant from the Government of the Autonomous Region of the Canary Islands, the spread, volume, and variety of sources of cultural heritage—well beyond the range of European culture—which it makes available under the open-access paradigm. It has meanwhile been developed to encompass over fifty scientific and cultural institutions and to present more than 130,000 high-resolution images and 54,000 full-text page transcriptions in several languages <http://www.echo-project.net>.

→ "The Virtual Laboratory" p. 100

ECHO has led to the creation of a generic and sustainable infrastructure, presented in 2004 at an international conference funded by the European Commission. It has also prepared a common ground for a great variety of IT-based projects within the MPG and beyond, offering an 'agora,' a forum of interchange between content providers, scholars, developers, and the public-at-large. The success of the ECHO initiative can be considered as a proof of principle of the 'agora dynamics' constituted by the cumulative enrichment of existing 'seed collections,' the interlinking of different corpora, and the generalization of specific instruments into modules of a generic infrastructure.



Seed Collections. Made publicly available within the ECHO infrastructure, http://www.echo-project.net

This success has become one of the points of departure for the creation of the Max Planck Digital Library (MPDL), conceived as a new central scientific service unit of the MPG responsible for strategic planning as well as the development and maintenance of electronic infrastructures that will provide the institutes with scientific information and support web-based scientific communication. It will integrate existing activities, among them a five-year project undertaken jointly by the MPG and the Fachinformationszentrum Karlsruhe (FIZ) and supported by the Federal Ministry for Education and Research (BMBF). This project starts from existing innovative para-

digms, such as the ECHO platform, that will be evolved, in the context of this project, into a generic scholarly workbench representing an essential part of the future Max Planck digital infrastructure <http://www.escidoc-project.de>.

The success of innovative infrastructures for the humanities, such as the ECHO platform, has also triggered a Europe-wide effort to develop large-scale research infrastructures, for the humanities too, an effort that is reflected both in the foci of the Seventh Framework Program and the intergovernmental ESFRI process (European Strategy Forum for Research Infrastructures). The vision of the Internet as a medium offering open access to both science and culture is implicit in the ECHO Charter and was later formulated in the widely acclaimed Berlin Declaration <http://www.zim.mpg.de/openaccess-berlin/berlindeclaration.html>. The Berlin Declaration, meanwhile signed by more than 160 institutions worldwide, was launched by the MPG in 2003 at an international conference organized by the MPIWG and became a key issue at the first World Summit on the Information Society, held in Geneva in 2003. The Berlin Open Access Conference 2003 was the first in a series of international open-access conferences. These brought together the rapidly growing number of signatories of the Berlin Declaration in order to design a common roadmap, to discuss the creation of institutional repositories, as well as the conditions for open-access publications on the background of a historical change in the media of knowledge production and dissemination.

The potential of the history of science as a mediator between science and society has been explored in yet another dimension during the period covered by this report, by exploring new forms of combining scholarly communication with public outreach. The external occasion for this exploration was provided by the International Year of Physics and the celebration of the Einstein Year 2005 in Germany. The Institute's central role in shaping this year also created numerous occasions for young historians of science to explore a wide-range of professional options, ranging from exhibition making, via didactics in the history of science for all age levels, to science journalism. The key event of this year was the large exhibition "Albert Einstein: Chief Engineer of the Universe" of the MPG, held from May to September 2005 at the Kronprinzenpalais, Unter den Linden in Berlin, conceived by the Institute, and funded by the MPG along with numerous other sponsors. The exhibition and its comprehensive accompanying program realized new ways of presenting the results of historical investigations of science in its cultural, technological, and political contexts to a broader public <http://www.einsteinausstellung.de>.

The research, development, and outreach activities in the period covered by this report have created the conditions for a significant extension of the network of scholarly cooperations beyond the department's traditional partners in Europe and the US. The ECHO initiative, the activities during the Einstein Year, and the preparation of the new globalization project have stimulated institutions throughout the world to seek scientific cooperation and participation in the department's projects and initiatives. With regard to Africa, the ECHO infrastructure has become an instrument for overcoming the digital divide, creating access to cultural heritage from Sudan and Mali (Cornelia Kleinitz) <http://echo.mpiwg-berlin.mpg.de/content/ethnologycollection/dogon>. With regard to Asia, the department's cooperation with the Partner Group at the Chinese Academy of Sciences has been strengthened by the perspective

of establishing a new Junior Research Group at the Institute to investigate innovation processes and traditions of technical development in China. Furthermore, the potential for scientific collaboration between academic and cultural institutions in Mongolia and the MPG was explored in 2005 by a visit from a MPG delegation, including members of the department, that resulted in the prospect of an extension of both the ECHO network and the scope of the globalization project. Similar cooperations are under negotiation with academic institutions in Uzbekistan. With regard to Latin America, the existing cooperation with Brazilian institutions has been consolidated while new cooperations with scholars and institutions in Cuba and Mexico have been launched.

Project 1

The Relation of Practical Experience and Conceptual Structures in the Emergence of Science: Mental Models in the History of Mechanics

General Goals of the Project

The goal of the project is to study the causes and long-term developments of scientific knowledge. The project is focused on mechanics as a part of science that has extraordinary significance for the development of science in general. In particular, and more so than other disciplines, mechanics has a continuous tradition from its origins in antiquity to the elimination of fundamental categories of mechanics by modern physics. Presently, the scope of the project is restricted to the period from antiquity to the emergence of classical mechanics in early modern times. However, it is intended to follow up the research questions of the project to the twentieth century.

The peculiar longevity of mechanics has given rise to speculations that the experiential basis of such scientific knowledge must be of a special kind, distinct from that of other sciences, which emerged much later. It has been claimed, for instance, that knowledge in mechanics or in mathematics is rooted in an essentially universal everyday experience, or even based on *a priori* structures of thinking. However, these and other speculations involve a very restrictive notion of experience. They exclude the by no means universal experience that human beings acquire in a historically specific material environment when dealing, for example, with the technology of their times. Therefore, the project is focused in particular on the historical reconstruction of such collective, practical experiences and their influences on the structure and content of scientific knowledge. Its main goal is to study the role of practical experience for the emergence and development of fundamental scientific concepts of mechanics, such as those of space, matter, force, time, and motion, and to reconstruct the patterns of explanation they were used for.

→ "Experimental History of Science" p. 143
→ "Materials in the History of Science and Technology" p. 127

An analysis of the relation between the various layers of knowledge and their development requires an appropriate description of their architecture. Evidently, formal logic is of little help here. In contrast to the inferences of formal logic, scientific conclusions can be corrected. Not only scientific knowledge but in fact large domains of human experience are not simply lost when theories are revised, even if this knowledge does not explicitly appear in such theories. In our description of the architecture of scientific knowledge we therefore make use of concepts from default logic such as the concept of a mental model, adapting them to an account of the historical development of the shared knowledge at the basis of science. We conceive of mental

models as knowledge representation structures based on default logic which allow inferences to be drawn from prior experiences about complex objects and processes even when only incomplete information on them is available. Mental models relevant to the history of mechanics either belong to generally shared knowledge or to the shared knowledge of specific groups. Accordingly, they can be related either to intuitive, to practical, or to theoretical knowledge. They are, in any case, characterized by a remarkable longevity—even across historical breaks—as becomes clear when considering examples such as the mental models of an atom, of a balance, of the center of gravity, or of positional weight. Their persistence in shaping the shared knowledge documented by the historical sources becomes particularly apparent in the consistency of the terminology used, a consistency that offers one important element for an empirical control for the reconstruction of such mental models and their historical development.

Some of the overarching questions of this project are also pursued in the framework of the European Science Foundation (ESF) Research Networking Programme "From Natural Philosophy to Science," co-initiated by the department in 2002 <http://www.esf.org/esf_article.php?language=0&article=334&domain=4&activity=1>; <http://www.phil.kun.nl/center/esf/>. The program focuses on the factors involved in transforming natural philosophy into the physical sciences. The period covered extends roughly from the introduction of Aristotle's works into the nascent universities to the establishment of stable scientific institutions such as the Royal Society or the Académie des Sciences, whose activities were characterized by experimentation, mathematical modelling, the publication of research results (in vernacular scientific languages), and the sponsoring of scientific collaboration. The program is subdivided into four teams, each of which organizes four workshops in the period 2003–2007. One of the workshops, to which the department contributed, entitled "Mechanics and Natural Philosophy: Accommodation and Conflict," was held in Tenerife in 2004 and was devoted to key factors shaping the "mechanization of the world picture." Another workshop "The Machine as Model and Metaphor" will be held in Berlin in 2006.

Intuitive Mechanics

Mechanical knowledge significantly predates any systematic theoretical treatment of mechanics. The most basic knowledge presupposed by mechanics is based on experiences acquired almost universally in any culture by human activities. It includes the perception of material bodies and their relative permanence, their impenetrability, their mechanical qualities, and their physical behavior. The outcome is an "intuitive mechanical knowledge" embedded in a qualitative physics, which is built up in ontogenesis and guides human activities related to our physical environment <http://echo.mpiwg-berlin.mpg.de/content/intuitivephysics>.

A dissertation project on intuitive physics (Katja Bödeker) has been completed. In view of the lack of sufficient empirical evidence on the universal character of intuitive physics, the project has included field research both in Germany and on the Trobriand Islands. The first step was a study with German school children, conducted with

the aim of analyzing the ontogenetic development of intuitive conceptions of force, motion, weight, and density. In order to examine which aspects of intuitive physical thinking and its development belong to universal cognitive structures, a parallel investigation was carried out in Kiriwina (Trobriand Islands, Papua New Guinea). The same tasks given to the German school children were presented to Trobriand children and adults. To control for possible influences of schooling, two groups were studied: the first group consisting of children attending the Catholic mission school in Gusaweta, and the second group consisting of illiterate adults and children living in a remote Trobriand village (Iuwada). The evaluation of the extensive documentary material collected during the expedition has been completed.

Children experimenting with a vacuum in the Comenius-Garden in Berlin.

Professional Knowledge of Practitioners

A second kind of mechanical knowledge, which predates any systematic theoretical treatment of mechanics, is the knowledge achieved by the use of mechanical tools. In contrast to intuitive mechanical knowledge, this type of knowledge is closely linked to the production and use of tools by professionalized groups of people and it consequently develops in history. The professional knowledge of practitioners is historically transmitted by immediate participation in practices such as the processes of labor and production in which such tools are applied and by the oral explanation that accompanies their application. Research on professional knowledge related to mechanics has been mainly dedicated to the study of the tradition of engineering knowledge in the early modern period. To facilitate the study of contemporary engineering drawings and to enable systematic comparisons of the wealth of information contained in these drawings, an analytical database has been developed that allows a standardized description of the images and enables systematized comparisons, as is customary for texts or quantitative data (Wolfgang Lefèvre, Marcus Popplow). This database meanwhile comprises around 1,500 engineering drawings ranging from the late middle ages until 1650 and includes hitherto unpublished materials. It will be published as an open-access resource in the framework of the ECHO initiative. A volume on the use, function, and consequences that engineering and architectural drawings had for Renaissance engineering has been published (Wolfgang Lefèvre).
In the early modern period, the increased significance and advancement of technology confronted the traditional body of mechanical knowledge with "challenging objects," such as the trajectory of projectiles, the stability of constructions, the oscillation of a swinging body, or the curve of a hanging chain. As becomes clear from the outstanding example of Galileo's *Two New Sciences*, these objects enriched the traditional

knowledge but also induced fundamental revisions of its structure, which led eventually to classical mechanics. A dissertation project dedicated to Galileo's activities as an engineer-scientist (Matteo Valleriani) has investigated conditions of this change and also sheds new light on hitherto neglected contexts of his writings. Complementing earlier findings about the relation between Galileo's science and practical knowledge with regard to his theory of motion and to his theory of the strength of materials, it has turned out that Galileo's conception of heat as exposed in his *Il saggiatore* in 1623 is rooted in the practical knowledge of contemporary engineers too, in this case in the knowledge of those who worked on pneumatics. In addition, research on the professional knowledge employed in shipbuilding has been continued, extending earlier research on knowledge organization in the Venetian Arsenal (Matteo Valleriani) and also on the relation between ship design and developments in fluid mechanics (Horst Nowacki).

Origins and Expansion of Theoretical Mechanics

Sources documenting early forms of mechanical knowledge and in particular ancient Greek and Latin texts on mechanics are being analyzed in order to reconstruct the emergence and developments of the first scientific representations of mechanical knowledge and the relation to intuitive knowledge and the professional mechanical knowledge of practitioners. Similarly, source texts from the early modern period, which is characterized by a rapid advancement of mechanical knowledge, are being investigated with the aim of understanding the transformation of ancient bodies of knowledge under the conditions of a different material and social culture. These investigations are also being pursued in the context of the SFB "Transformations of Antiquity" and the G.I.F. project "Jesuits on Statics, Dynamics, Mathematics and Astronomy between Galileo and Newton" <http://echo.mpiwg-berlin.mpg.de/content/jesuit>.

→ "Knowledge and Belief" p. 61

In conjunction with the Archimedes Project (Brian Fuchs, Peter Damerow, Mauricio Gatto, Peter McLaughlin, Jürgen Renn, Urs Schoepflin), a collection of several hundred sources related to mechanics has been accessioned and prepared for inclusion within the digital library. Whereas previously the Archimedes Project had concentrated on acquiring data such as digital images and transcriptions and on developing tools for presentation, in the period covered by this report, the project focused on content-curation and content-enrichment. Particular emphasis was placed on the development of workflows and tools for text correction, the generation of parallel texts in different languages, and dictionary supplementation. Parallel texts (Greek/Latin, Latin/Italian, and Greek/Latin/Italian, also English when available) were produced for central texts in the history of mechanics by authors such as Guidobaldo del Monte, Jordanus, Lucretius, and Heron of Alexandria. The project has developed a workflow for capturing new word formations and adding them to the project's online tools, such as the morphological analyzer and the search facilities, in order to make unusual linguistic structures, such as the increasing occurrence of Latin neologisms in early modern texts amenable to analysis <http://archimedes.mpiwg-berlin.mpg.de>.

The analysis of such a huge body of texts with new, computer-assisted methods has

yielded new insights into the shared knowledge structures that shaped mechanical thinking and the long-term development of these structures. The force of the shared knowledge resources of early modern mechanics, in addition to common challenges and the similar social environment of patronage conditioning the communication of scientific information, on the work of contrasting authors such as Galileo, Harriot, Stevin, or Descartes has been a main focus of research in the period covered by this report, in particular in the context of two dissertation projects.

In sequel to the extensive work invested into making Galileo's manuscripts accessible on the Internet, his notes on mechanics are being analyzed in the context of a dissertation project (Jochen Büttner). A detailed reexamination of this vast collection of research notes reveals, contrary to the published *Discorsi*, the challenging problems that motivated and shaped Galileo's thinking. It turned out that the problem of reducing the properties of pendulum motion to the laws governing naturally accelerated motion on inclined planes was the mainspring for the formation of Galileo's comprehensive theory of naturally accelerated motion. It could furthermore be shown how explorative experimentation substantiated the conceptual structures of the emerging theory. The dissertation was deliberately written in a format suitable for both print and electronic publication and thus for a seamless integration into the existing electronic representation of Galileo's notes on motion via hyperlinks.

Another dissertation project that was dedicated to similar research notes by Thomas Harriot, one of Galileo's most important contemporaries, has been completed and is being prepared for publication (Matthias Schemmel). Harriot and Galileo exploited the same shared knowledge resources in order to approach the same challenging subjects. While the paths Harriot traces through the shared knowledge are different from Galileo's, the work of the two scientists displays striking similarities as regards their achievements as well as the problems they were unable to solve. The study of Harriot's parallel work thus allows the exploration of the structure of the shared knowledge of early modern mechanics, to perceive possible alternative histories, and thus to distinguish between individual peculiarities and shared structures of early modern mechanical reasoning.

Independent Tradition and Knowledge Transfer—the Case of China

The question of whether science originated only once in history or whether it has multiple origins has rarely been analyzed as systematically as, for example, the structurally similar question of the single or multiple origin of the human species. The default assumption is still that science represents a human enterprise that, while having received contributions over time from various cultures, has actually originated only once, in Greek antiquity. The research activity on the science of mechanics in China has shed new light on the question of independent developments of knowledge, challenging the rationale behind default responses (this line of research will in the future be supplemented by the work of the Independent Research Group "From Invention to Innovation: Cultural Traditions of Technical Development in China"). It has also helped to understand the transformation processes of scientific knowledge when transferred from its culture of origin to another.

In joint work with the Partner Group at the Institute for the History of Natural Sciences of the Chinese Academy of Sciences, the exchange of practical and scientific knowledge between China and Europe in the early modern period has been investigated (Chen Yue, Peter Damerow, Jürgen Renn, Matthias Schemmel, Tian Miao, Xiao Yunhong, Yin Xiaodong, Zhang Baichun, Zou Dahai). In the period covered by this report, several working meetings have taken place, involving the members of the Partner Group's advisory board as well as further collaborators of the Institute (in addition to the names already mentioned, William Boltz, Rivka Feldhay, Fung Kam-Wing, Malcolm Hyman, Liu Dun, Simone Rieger, Urs Schoepflin, Hans Ulrich Vogel).

Workshop with the research group of Dept. I, the Chinese Partner Group and the Advisory Board. Beijing, 2004. From left, Rifka Feldhay, Tian Miao, Fung Kam-Wing, Jürgen Renn, Simone Rieger, Matthias Schemmel, Hans-Ulrich Vogel.

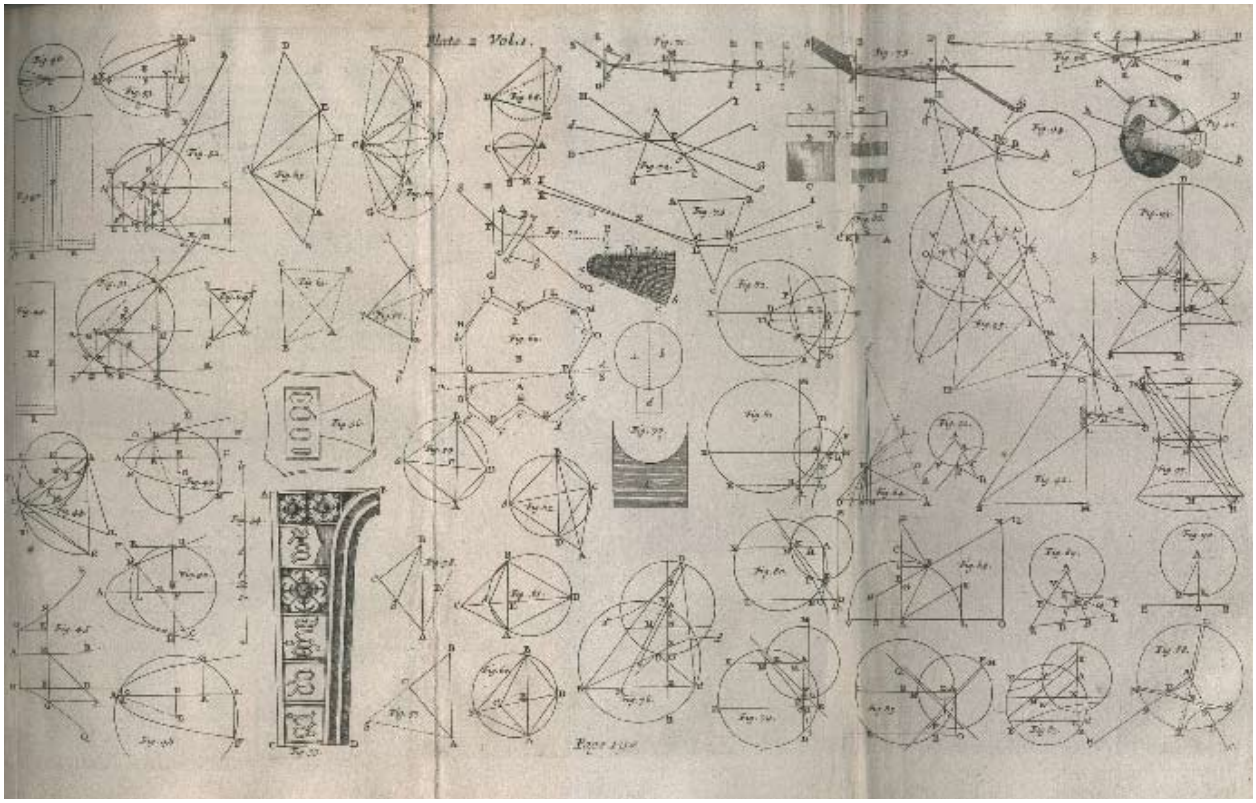
The work focused on the *Yuanxi Qiqi Tushuo Luzui*, the first monograph on western mechanics ever to be compiled in Chinese. In order to introduce this science to China, the authors of the *Qiqi Tushuo*, Wang Zheng (1571–1644) and Johann Terrenz Schreck (1576–1630), worked together on a Chinese presentation of western knowledge and machines from Archimedian times to the early seventeenth century, thereby merging the traditions of the two cultures. The *Qiqi Tushuo* has been made available on the Internet as a high-quality facsimile with introductory notes and as a transcription linked to a dictionary, together with further texts pertinent to the history of mechanics in China. This digital library on Chinese texts on mechanics is being further extended and has become part of the ECHO infrastructure (http://echo.mpiwg-berlin.mpg.de/content/chineseknowledge). Work on a commented English translation of the *Qiqi Tushuo* has been continued. In addition, a collection of essays on the history of mechanical knowledge in China and its interaction with western knowledge, comprising contributions by Partner Group members as well as by members of the Partner Group's advisory board and co-workers from the Institute, is presently being prepared. The essays deal with the concept of force in Chinese antiquity, the Chinese intellectual context of the *Qiqi Tushuo*, the introduction of the Galilean science of the strength of materials, through the Jesuit Verbiest, the influence of Western ballistics in Chinese treatises on artillery, and other subjects related to the transfer and transformation of knowledge.

The Parallel Cases of Optics and Music

The development of mechanics as the result of an interaction of practical knowledge with other forms of knowledge ranging from antiquity to the early modern period finds its parallels in the evolution of optics and music theory as fields of scientific knowledge similarly dependent on the accumulated experiences of practitioners. These parallel developments have in the context of the work of the department so far only been made the object of individual studies, in particular, on the role of the Camera Obscura as an optical instrument (Wolfgang Lefèvre), on Newton's *Opticks* (Volkmar Schüller), and on the development of the theory of proportions and its relation to musical practice and theory (Oscar Abdounur).

→ "Common Languages of Art and Science" p. 83

Isaac Newton, *Debate on Newton's New Theory about Light and Colors.* vol. I, pp. 128–172, 1716



Project 2

Reorganizing Knowledge in Developed Science: The Rise and Decline of the Mechanical Worldview

General Goals of the Project

The goal of the project is the study of the emergence and dissolution of core groups of concepts that structure the vast knowledge embodied in the mechanical worldview as a result of processes of knowledge integration and disintegration. In the context of the project, the emergence of such a core group of foundational concepts is conceived as a restructuring of the cognitive organization of previously acquired knowledge. Core concepts of the mechanical worldview such as space, time, force, motion, and matter achieved their privileged position in the organization of knowledge only after a long process of knowledge integration in a material, social, and cognitive sense. Such concepts proved to be extremely stable in the face of an enormous growth of knowledge in the course of the further development of science. Nevertheless, physics, like many other scientific disciplines, has witnessed in the past century fundamental changes of precisely such core groups of foundational concepts. These fundamental changes were preceded by more or less extended periods of knowledge disintegration, in which the established cognitive organization of knowledge became problematic. Processes of integration and disintegration of knowledge are studied in close connection within the project since it has turned out that the essential mechanisms at work in periods of destabilization were of the same nature as those in the original processes of the emergence of core concepts of a discipline.

→ for the role of experimental systems in such processes see also: "Generating Experimental Knowledge" p. 111

→ "A Cultural History of Heredity" p. 102

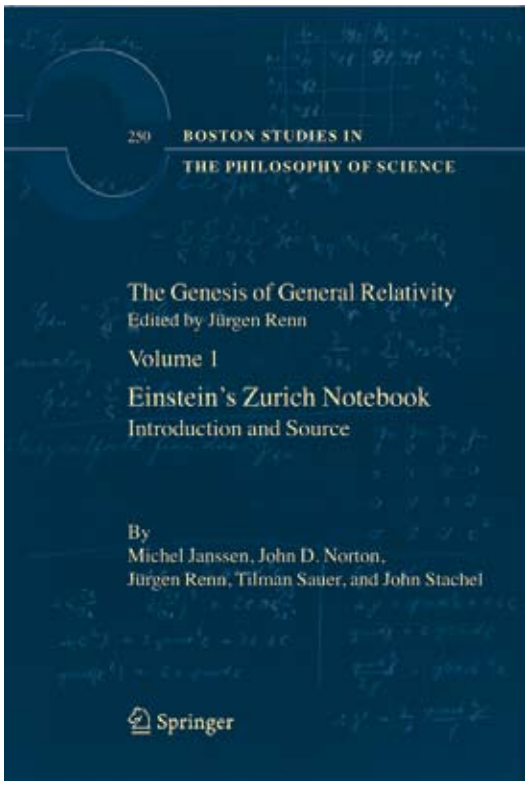
The project focuses on the history of the central mental models that shaped scientific thinking in the periods ranging from classical mechanics to the revolutions of modern physics and that challenged fundamental categories of mechanical thinking. It also traces the far-reaching restructuring introduced by the analytical tradition and disciplinary organization of scientific knowledge. The results already achieved for the emergence of the new concepts of space and time in the context of the two relativity theories are being complemented by similar research on the emergence of new notions of matter and causality established in the context of quantum theory.

The Relativity Revolution

As a result of a collaboration that extends over a decade a major four-volume work *The Genesis of General Relativity* (Michel Janssen, John Norton, Jürgen Renn, Tilman Sauer, Matthias Schemmel, John Stachel) has been published. It is based on a meticulous investigation of the relevant primary sources, which are reproduced together with detailed commentaries. The first two volumes analyze the interplay of physical and mathematical knowledge in the development of general relativity between 1907 and 1915. They provide, at the same time, a systematic account of the shared classical knowledge in which Einstein's theory is rooted. The second two volumes deal with the scientific context of Einstein's search for a new theory of gravitation, the largely unexplored history of alternative approaches to the problem of gravitation in late classical physics.

Apart from the conclusion of this major publication project, several other research activities were dedicated to investigating the relativity revolution, its preconditions and consequences. The transition from Newtonian mechanics of point particles to relativistic continuum mechanics was studied, focusing on major shifts in the categories for dealing with the motion of physical systems, in this case changes in such concepts as mass, force, and momentum (Michel Janssen and Matthew Mecklenburg). The ensuing paper, dealing with electromagnetic models of the electron proposed in the period 1895–1911, shows the central role of the electromagnetic view of nature, which competed with special relativity in its early days in this transition.

The Einstein Year 2005 offered an occasion for further scholarly activities dealing with the relativity revolution. The MPIWG co-organized the 7th Conference on the History and Foundations of General Relativity in La Orotava, Tenerife, together with the Fundación Canaria Orotava de Historia de la Ciencia and the Instituto Astrofísico de Canarias. Careful reviews of conceptual conflicts and a hitherto unique attempt to compare systematically the science of the universe in our times with the mechanical worldview at the beginning of the 20th century were at the center of the talks and discussions. A volume with selected papers from the conference will be published in the series *Einstein Studies*, edited by John Beckman, Christoph Lehner, and Jürgen Renn.



Cover of the four-volume work *The Genesis of General Relativity* (Ed. Jürgen Renn).

The department also co-organized the session "Einstein in Context" at the 22nd International Congress of History of Science 2005 in Beijing. In the session recent work on the cultural and intellectual contexts of Einstein was reviewed, ranging from studies of Einstein's relation to the Vienna Circle or to Henri Poincaré, via examinations of the reception of his work under politically diverse circumstances, to discussions of Einstein as a public figure and pop icon. A central event of the congress was the opening of the Chinese version of the exhibition "Albert Einstein: Chief Engineer of the Universe" prepared by the Institute (see below).

Also in the Einstein Year, a number of publications on Einstein's life and science have been prepared by members of the department, in addition to the books and papers directly connected to the Einstein exhibition. Among them are an edition of Einstein's *Annalen* papers that includes interpretative essays (Jürgen Renn), a comprehensive analysis of the structures of Einstein's relativity revolution (Jürgen Renn), a book on Einstein in Berlin (Dieter Hoffmann), a popular, best-selling biography (Jürgen Neffe) as well as a short biography (Dieter Hoffmann, Robert Schulmann), a book on Einstein's political and pacifist heritage (Reiner Braun), and a historical reconstruction of Einstein's scientific achievements in his *annus mirabilis* 1905 (Jürgen Renn, Robert Rynasiewicz). Some of these works have appeared under the umbrella of a newly founded series *Abenteuer Wissensgeschichte*, edited by Jürgen Renn. Other publications are in preparation, such as a book on the German Physical Society in the Third Reich (Mark Walker, Dieter Hoffmann), and a volume on Einstein in the *Cambridge Companions to Philosophy* series (Michel Janssen and Christoph Lehner). Furthermore numerous original sources have been made freely available online in the context of these activities, such as Einstein's *Annalen* papers <http://www.physik.uni-augsburg.de/annalen/history/Einstein-in-AdP.htm>.

A dissertation project is dealing with the opposition to the theory of relativity in the broader public in the 1920s (Milena Wazeck). It focuses on popular concepts of science and nature on which the critique of relativity is based and investigates both on an epistemological and a social level the struggle against modern physics as a process of the marginalization of popular knowledge claims. The dissertation draws on new source material from the papers of the fervent Einstein opponent Ernst Gehrcke (1878–1960) which the MPIWG recently acquired. Parts of the papers, including a newspaper article collection that contains around 3,000 articles on Einstein and the theory of relativity from the early 1920s, were digitized and made available within the framework of ECHO <http://echo.mpiwg-berlin.mpg.de/content/relativityrevolution/gehrcke>.

→ "Knowledge and Belief" p. 61

The Quantum Revolution

As a continuation of the studies of the relativity revolution, the department has been preparing a research initiative dedicated to the history of quantum theory. The development of quantum theory since the early twentieth century has been one of the most complex shifts of foundational concepts in the history of physics. The ongoing discussions about the interpretation of quantum theory imply that we are still in the middle of this process. It presents a special challenge to the historian to work on shifting ground, but also makes the historical work highly relevant for the contemporary foundational debate in physics. The research initiative (co-ordinated by Christoph Lehner) was inaugurated with presentations on quantum dispersion theory in the mid-1920s just before the breakthrough to matrix mechanics by Heisenberg (Anthony Duncan, Michel Janssen). One central task of the planning process was to establish a network of historians, physicists, and philosophers to work together on a detailed analysis of central steps in the history of quantum theory. The search for collaborators has been successful, and contacts were established with institutions, archives, and individuals in the United States, the United Kingdom, France, Italy, the Netherlands, and Austria. A first meeting with over twenty scholars interested in an institutionalized cooperation was held at the MPIWG in June 2006. Parallel to this process, a cooperation was established with the Fritz Haber Institute of the MPG with the aim of establishing a center for the international network and publishing sources and review articles on the history of quantum physics. A joint proposal for funding this research initiative from the Strategic Innovation Fund of the President of the MPG has just been approved and granted. Among other things, the project aims to make historical key sources available on the Internet, e. g. the Archives for the History of Quantum Physics.

→ "Experimental History of Science" p. 143

→ "Knowledge Management at the MPIWG" p. 61

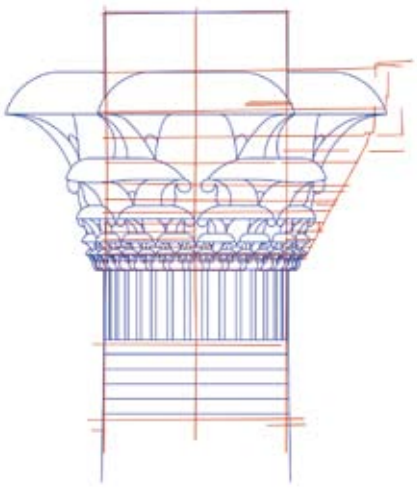
The research initiative also builds on earlier research undertaken at the Institute on the history of quantum theory (Giuseppe Castagnetti, Dieter Hoffmann, Horst Kant) as well as on ongoing work on statistical physics (Massimiliano Badino, Jürgen Renn). This research concerns the institutional context of quantum theory, and in particular the effect of contemporary scientists' recognition of quantum problems and their interrelations to the shifting of their research foci, reallocation of their resources, and reorganization of research structures and policies. A book project on the readjustments of research policies in reaction to the quantum crisis, which comprises two major studies, one on Einstein's role at the Kaiser-Wilhelm-Institut für Physik in Berlin, the other on Niels Bohr and his institute in Copenhagen has been completed (Giuseppe Castagnetti, Hubert Goenner, Alexei Kojevnikov).

Project 3

Epistemic History of Architecture

This project, a joint research endeavor with the Bibliotheca Hertziana, is dedicated to investigating the knowledge involved in architectural achievements from the first constructions of the Neolithic period to modern, science-based building technology. It thus comprises types of knowledge ranging from knowledge implicit in the rules of practitioners to scientific theories and technologies applied to the planning and realization of modern architecture. The aim is to reconstruct the systems of knowledge incorporated in the building process itself and their interaction with other knowledge systems. This reconstruction requires a broad approach in order to analyze geographically, chronologically, and culturally different forms of building processes, ranging from erecting a one-room dwelling to the construction management of complex monumental architecture <http://www.biblhertz.it/deutsch/forschung/wissensgeschichte.htm>.

A first major international conference within the framework of the project was held in 2003 at the Bibliotheca Hertziana and dedicated to early modern Italian architecture. The resulting volume is in press (edited by Hermann Schlimme.) A second workshop, dedicated to building traditions of the early cultures in Mesopotamia, was held in 2004 at the MPIWG (organized by Claudia Bührig.) Also in 2004, an exhibition and a workshop, co-organized with Bern University, dealt with the Hagia Sophia at Konstantinopolis/Istanbul, the most prominent architectural object to be realized in the centuries between late antiquity and the Middle Ages (Claudia Bührig, Volker Hoffmann, Wolfgang Lefèvre).



Architectural drawing of an Egyptian capital (red) in comparison to a finished capital (blue) from the temple of Edfu, around 100 B. C. The photo shows an unfinished capital from the temple of Philae from the same period.

Research in the early part of the project dealt with a broad variety of topics from different historical periods, ranging from neolithic architecture (Dietmar Kurapkat) via cuneiform sources related to the role of architects in ancient Mesopotamia (Blahoslav Hruška), the role of technical drawings from Mesopotamia to late antiquity (Claudia Bührig), to the early role of mechanical analysis in architecture, focusing on the work of Bernardino Baldi (Antonio Becchi).

At the end of 2005, there was a change in the MPIWG's side of the research team. Wilhelm Osthues, specialized in the architecture of Ancient Greece and Rome, is now directing the team, and Ulrike Fauerbach is working on the building trade in pharaonic Egypt. Under its new direction, the project team plans to publish, in co-operation with the Bibliotheca Hertziana, a collection of review articles and individual essays on key issues of an epistemic history of architecture, focusing on the neolithic period, Mesopotamia, Egypt, Greek and Roman antiquity, early Middle Ages in northern Europe, and the Italian Renaissance. The project will thus combine detailed case studies with a first attempt at a synthetic history of knowledge development in the realm of architecture.

The analysis of knowledge implicit in practice has further reaching significance. In a period in which the conflict-laden integration of traditional and industrialized societies no longer takes place on the level of colonial struggles, but on that of knowledge resources and value orientations, the understanding of systems of knowledge implicit in practice may be of vital interest for determining the role of science in this process of integration.

Project 4

The Globalization of Knowledge and its Consequences (in preparation)

The goal of the project is to study—focusing on specific research themes—conditions, pathways, and consequences of globalization processes of knowledge. The project is conceived as a multi-disciplinary and multi-national project in which smaller research groups from various countries participate. These research groups with specific, in part discipline-bound research goals form the core of the project. The collaboration of these research groups towards the common overarching aim shall be realized by workshops and a regular exchange of scholars.

According to preliminary discussions with potential partners of the project, the following thematic foci are emerging:

1. The spreading of culture in the Mediterranean area and neighboring regions;
2. Knowledge transfer among Europe, Middle East, India, and East Asia;
3. Transatlantic colonization and exchange processes; and
4. Culturally specific knowledge potentials and the import of globalized knowledge.

The planned project aims at integrating the results of specific research with a view to overarching questions concerning the conditions of knowledge transfer by persons, documents, and products, the mechanisms of the knowledge transformations induced by transfer and synthesis, as well as the conditions for the globalization of local knowledge. It builds on a variety of research activities that have so far been pursued independently and are now being integrated. Among these activities are the study of the invention of writing in various cultures (in the context of CDLI), of the transmission of European scientific knowledge to China by the Jesuits, pursued jointly with the Chinese partner group, of the exchange of knowledge by scientific voyages, pursued jointly with the Fundación Canaria Orotava de Historia de la Ciencia, and of the scientific and technological relations between Germany and Spain during the 20th century as an example for the export of scientific and technical knowledge and scientific organization models (Albert Presas i Puig). The ECHO initiative will provide an important empirical basis for studies undertaken in the context of the globalization project as it enables the comparison of sources from different cultures across the barriers of languages and media.

Some institutions, mainly in Europe, Asia, and Latin America, have already spontaneously decided to participate and have even offered financial support. Furthermore numerous potential partners have expressed serious interest in the planned project. In several discussions the intent to participate became clear, while funding possibilities have still to be explored.

Fig. 48. — Plateau du Guajara : la vue vers le Nord-Est.

Mascart, Jean. *Impressions et observations dans un voyage à Ténérife.* 1910

History of Science in Action: Public Outreach

General Goals

Based on the insight that scientific knowledge evolves as part of a comprehensive system of knowledge, new approaches to a public dialogue about science and its historical roots have been developed. These new approaches are distinguished by:

1. the representation of diverse worlds of knowledge that are subject to historical changes, along with the corresponding intellectual horizons of science and society as they evolve with these changes;
2. the representation of the multitude of premises for experiencing knowledge and science, taking into account the most diverse perspectives;
3. the representation of the diversity of the civilisatory and cultural spaces in which knowledge has developed historically, has been created or appropriated, and the communication between these spaces.

By introducing a historically informed perspective into the public discussion, the activities of the Institute have contributed to an awareness for the openness and plasticity of science, thus helping to overcome a polarized discussion shifting between the extremes of blind belief in progress and irrational hostility to science. Both positions are evidently based on the erroneous assumption that scientific progress is an automatism and not a historical process that can be shaped by mankind. If, however, science is connected by its very roots and not only *post factum* to other domains of society, unravelling these roots opens up opportunities for a new public understanding of science, relating it back to the sphere of human interventions. On this background, a new culture of science may emerge in which a public reflection on science can have repercussions on its cognitive and institutional structures.

The Einstein Exhibition

A new culture of science was at the center of discussions and outreach activities during the Einstein Year 2005, a common initiative of the Federal Government, science, industry, and culture. It celebrated the centenary of Einstein's revolutionary 1905 papers. A public understanding of science in its cultural and political contexts was also the focus of the large Berlin exhibition "Albert Einstein: Chief Engineer of the Universe," as well as of the extensive accompanying program and media activities surrounding it. The exhibition was inaugurated on 12 May 2005 by Edelgard Bulmahn, then Federal Minister of Science and Education

Inauguration of the Einstein Exhibition on 12 May 2005 by Edelgard Buhlmahn, then Federal Minister of Science and Education (left); explainers guiding tours at the Exhibition (right).

In 2003, a project group of the department (including Katja Bödeker, Elena Bougleux, Reiner Braun, Jochen Büttner, Giuseppe Castagnetti, Peter Damerow, Circe Dynnikov, Carmen Hammer, Dieter Hoffmann, Horst Kant, Christoph Lehner, Jürgen Renn, Simone Rieger, Matthias Schemmel, Sandra Schmidt, Michael Schüring, Urs Schoepflin, Ekkehard Sieker, Kurt Sundermeyer, Matteo Valleriani, Milena Wazeck) began to prepare the exhibition together with other Max Planck Institutes, international partners, an international and interdisciplinary scientific advisory board, exhibition makers (Stefan Iglhaut and his team), and media representatives. A close cooperation with the Hebrew University of Jerusalem, the Deutsches Museum München, and the University of Pavia, and cooperation with the Federal Ministry for Science and Education as well as funding by the Kulturstiftung des Bundes, the Ministry, the Heinz-Nixdorf, the Robert-Bosch, and the Klaus-Tschira Foundations as well as other foundations, firms such as BASF and SIEMENS, and partners, such as DESY and CERN, laid the foundations for the success of the exhibition.

Children visiting the Einstein exhibition.

From 16 May to 30 September 2005 more than 130,000 visitors experienced the exhibition as a highlight of the Einstein Year. Staging the history of science as an adventure of discovery and struggle for knowledge, the exhibition succeeded in reaching a broad public. It was particularly acclaimed by younger visitors. More than 10,000 students and children participated in guided tours or in workshops held at the exhibition.

The Einstein exhibition at the Kronprinzenpalais in Berlin.

The goal of the exhibition was to take the life and science of Albert Einstein as a guide for illustrating the historical change of scientific worldviews and the development of science in a broadly understandable way. Einstein's biographical path was set in the context of the political and social cataclysms of his time. By connecting history of science and history of culture, visitors were offered a perspective on Einstein's biography that transcended the traditional image of an ingenious and exceptional scientist. Scientific knowledge was not offered as a collection of rigid facts but as part of a dynamical, multi-facetted cultural process. Indeed, it was not the exhibition's primary aim to provide fixed answers, but rather to encourage the visitors to question and interact with the contents of the exhibition. The representation of historical worldviews and the reference to present challenges of the sciences animated the visitors to develop their curiosity, to discover the cultural dimension of scientific knowledge, and to address questions about the social and political significance of scientific research.

Media of Science Communication

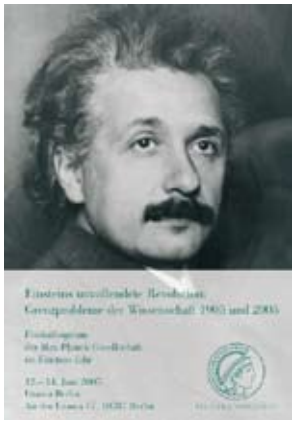
The wide range of scientific and cultural themes of the exhibition as well as its pedagogical intentions represented challenges that were addressed with the help of diverse approaches of science communication, ranging from the creation of historical ambientes and of artistic stage settings via the employment of multimedia, a pedagogical program that included explainers, guided tours, and special workshops, to the publication of a three-volume catalogue representing, at the same time, a high-level popular introduction to the history of science as pursued at the Institute.

Concerning the use of multimedia technology, the exhibition project developed new approaches, for instance, combining historical objects with interactive electronic media in the exhibition and, at the same time, enabling access to the exhibition contents via a virtual exhibition freely available on the Internet <http://www.einsteinausstellung.de>. Even after the closure of the Einstein exhibition, the virtual exhibition continues to offer, with more than 1,000 continuously extended and updated pages, a living panorama of the history of science that is useful as a learning and teaching tool but also as a resource for the history of science, and that guarantees the long-term availability of the contents assembled for the exhibition. In the exhibition, original historical instruments such as a Leyden jar were accompanied by computer animations that allowed an interactive exploration of the way they function. Furthermore, special films were produced showing fictive dialogues among historical personalities illustrating, for instance, the crisis of physics around 1900. Einstein's reaction to this crisis and his attempts at solving it have also been made the subject of such films. As will be explained in more detail below, approximately 50 media stations distributed all over the exhibition—and at the same time accessible via the Internet as part of the virtual exhibition—offered the visitors different ways of consulting additional information resources about the exhibits, or of participating in quiz games that encouraged children in particular to learn about the exhibits in a more playful manner. In the exhibition, the media stations, which also contain virtual exhibits such as historical films, audio material, or live transmissions from research institutions, became meeting points for spontaneous seminars among the visitors.

The catalogue of the exhibition actually represents a compendium of the history of science that focuses on changes in scientific worldviews as they were characteristic of Einstein's revolution. It consists of three volumes: The first volume closely follows the narrative structure of the exhibition; the second volume assembles more than 100 essays on the historical background of Einstein's life and work as well as on related issues of current research; the third volume offers a comprehensive documentation of original sources reproduced as high-quality facsimiles, setting Einstein's biography in the context of his times. In addition, a DVD with video and audio material from the exhibition was published, serving as a complementary resource to the virtual exhibition and as a tool for science education and popularization.

Accompanying Program

The Einstein exhibition was accompanied by a program of scholarly and public events which connected its themes with the wider discourse on science and its contexts in the Einstein Year. For the Institute, this accompanying program was an opportunity to present the results of its research projects in a new ways and to extend its network of collaborations including media partnerships with TV and radio channels, newspapers, journals, and magazines. The program addressed a broad variety of age and interest groups and comprised public lectures, theatre plays, cinematographic events, round-table discussions, TV and radio events, newspaper and journal contributions, summer camps for students, international school conferences with students from Poland, Switzerland, Italy, and Germany, children's events, etc. One of the highlights of the accompanying program was an interdisciplinary lecture series, entitled "Einstein Lectures," co-organized with the three Berlin Universities and the Young Academy of Sciences in Berlin, and attended by more than 2,500 participants.



The "Einstein Lectures," held at the Berlin-Brandenburg Academy of Sciences (right), and the cover of the DVD with the collected lectures of the celebratory colloquium "Borderline Problems of Science 1905 and 2005" (left).

Of the Institute's many contributions to the Einstein Year, five major scientific conferences deserve a special mention: the 22nd International Congress for the History of Science in Beijing; the 7th International Conference of General Relativity in Tenerife mentioned previously; the international conference "Discovery, Creativity and Innovation. Einstein's *annus mirabilis*" in Bern, co-organized by the MPIWG together with the University of Bern; the international conference "Einstein and Europe" in Düsseldorf, co-organized by the MPIWG together with the Wissenschaftszentrum Nordrhein-Westfalen and the Royal Netherlands Academy of Arts and Science, focusing on the framing conditions for science after Einstein; and the celebratory colloquium "Borderline Problems of Science 1905 and 2005" organized by the Institute on behalf of the MPG at the Berlin Urania Congress Center.

Both the exhibition and the accompanying program were embedded in a network of international co-operations. The international partners of the exhibition, for instance, had the opportunity to present their contributions during special events such as the "Italian Night" or the "Chinese Night." These events also served to introduce the parallel versions of the exhibition that were shown in China and in Italy and that are being prepared for inclusion in the virtual exhibition. The Berlin exhibition team furthermore supported other Einstein exhibition projects, such as an Einstein

exhibition in Potsdam and another in Japan. Close co-operation with the Hebrew University of Jerusalem, in particular with the Albert Einstein Archives, made it possible to display, document, and analyze the uniquely valuable original documents from its holdings. The co-operation with media partners of the exhibition enabled the Institute to build up a collection of interviews with contemporary witnesses. Finally, co-operations with a wide network of research institutions, ranging from other Max Planck Institutes to research centers such as DESY and CERN, not only created the presuppositions for addressing issues of current science in the exhibition, but also continue to serve as important reference points for the interdisciplinary research projects of the department.

History of Science in Action: Development of Electronic Research Tools and Databases

General Goals of the Developments

Recent developments in electronic data processing have fundamentally changed the potential of research in the history of science as well as in other disciplines. The electronic storage of historical sources improves their accessibility and makes new and powerful methods of retrieving of information possible. Scanning and optical character recognition techniques are being used to build electronic archives of historical sources, and databases and software tools are being developed to assist research and editorial activities. These activities aim at the creation of working environments that allow the integration of historical details into coherent models of historical developments. They are based on both the availability of a wide range of sources accessible to the scientific community as a whole, within the framework of open digital research libraries, and on scholarly cooperations extending well beyond a single institution. These cooperations, characterized by a novel unity of research and dissemination, are by their very nature international and interdisciplinary. They draw on the potential of the World Wide Web to cut across the traditional distinctions of research institutions, universities, and libraries.

→ "Knowledge Management at the MPIWG" p. 161

The Cuneiform Digital Library Initiative as an Example for an Open Digital Research Library

The Cuneiform Digital Library Initiative (CDLI: Jacob Dahl, Peter Damerow, Robert Englund) represents the ongoing efforts of an international group of Assyriologists, museum curators and historians of science to make freely available through the internet images and content of cuneiform tablets dating from the beginning of writing, ca. 3350 BC, until the end of the pre-Christian era. The number of these documents currently kept in public and private collections is estimated to exceed 500,000. More than 175,000 of these have now been catalogued in electronic form by the CDLI.

In its early phases of research, the project concentrated on the digital documentation of the least understood archives of ancient cuneiform, those of the final third of the fourth, and of the entire third millennium BC that contained texts in Sumerian, in early Akkadian and in other, still undeciphered languages. Despite the 150 years since the decipherment of cunei-form, and the 100 years since Sumerian documents of the third millennium BC from southern Babylonia were first published, basic research tools such as a reliable paleography charting the graphic development of archaic cuneiform, and a lexical and grammatical glossary of the approximately 120,000 texts inscribed during this period of early state formation, remain unavailable even to specialists, not to mention scholars from other disciplines

for whom these earliest sources on social development represent an extraordinary hidden treasure.

The CDLI data set consists of text and image, combining document transliterations, text glossaries and digitized originals and photo archives of early cuneiform. At present, the online catalog of the CDLI contains more than 175,000 catalog entries with information about tablets of the third millennium B.C., more than 16,000 digital images of these tablets, more than 41,000 hand copies, and more than 56,000 transliterations, all of which are accessible through the CDLI web site. This electronic documentation should be of particular interest to scholars distant from collections, and to museum personnel intent on archiving and preserving fragile and often decaying cuneiform collections.

In 2005 the CDLI made a concerted effort to include target text-groups from the 2nd millennium BC in the project's core set of data. Two texts groups were chosen for this first stage, the Middle Assyrian texts (ca. 2,000 texts dating to 1400–1100 BC), in cooperation with Professor Dr. Eva Cancik-Kirschbaum from the Freie Universität Berlin, and the Old Assyrian texts (ca. 22,000 texts dating to 1900–1800 BC), in cooperation with the Old Assyrian Text Project (Copenhagen). In addition to continuing digitization work in the Vorderasiatisches Museum, Berlin, and in minor European and North-American collections, the CDLI has begun, in a joint effort with staff from the Oriental Institute of the University of Chicago, to digitize and catalog the collection of about 8,000 cuneiform tablets housed there.

Royal inscription from the Ur III period (ca. 2100–2000 BCE), commemorating the construction of a temple of Inanna by the king Shulgi. (Birmingham City Museum, Birmingham, U.K., Museum no.: A.3104_1982)

From Browsers to Interagents

The current paradigm of the web—in which the user browses, leaving behind a click-trail that is of interest primarily to marketers—falls far short of the needs of scientists and scholars. Browsing the web is scarcely more interactive than surfing television channels. True interactivity—which will allow the web finally to achieve its potential as a medium for scholarly, political, and social dialogue—demands something other than the current browser/server paradigm. New tools will be needed, whose developers recognize that information consumers are also information producers. Scholarship is an inherently recursive activity, in that the scholar uses existing scholarship to produce new scholarship. Knowledge undergoes a process of accretion, akin to the

formation of a pearl; one exemplary model is a page of the Talmud, on which there is a hierarchical arrangement of commentary, super-commentary, annotation, and cross-reference that spreads from center to margin.

Although information production (and not just consumption) is beginning to emerge in the current web—consider such examples as Wikipedia—and will surely grow in the new paradigm referred to as "Web 2.0," true interactivity demands a new tool: not a browser, but an interagent or "knowledge weaver." With these ideas in mind, for the past few years, researchers in the department have been developing a prototype interagent called Arboreal (Malcolm Hyman). Arboreal allows for flexible, non-linear navigation of arbitrary XML documents and for granular annotation of these documents down to the word- or term-level, and is at present used extensively by the research projects of the department, e.g., in the context of the CDLI and the co-operation with the Chinese Partner Group. Annotations themselves are XML data, which can be shared, published, and further annotated in turn <http://archimedes.fas.harvard.edu/arboreal/>.

Since information is transmitted through the medium of language, Arboreal integrates linguistic technology through extensible components and web services. Language support is critical to the increasingly global enterprise of science, where researchers collaborate across barriers that are not only geographic but also linguistic. Language support includes not just display—although flexible options are needed for different scripts and transliterations—but also the identification of words, lemmatization and morphological analysis, and dictionary lookup. These are critical and basic functions that will serve as the foundation in the future for a richer set of facilities, including term and keyword discovery, language-neutral searching based on concepts rather than words, automatic summarization, and sophisticated semantic linking.

The historical materials studied at the Institute—which include manuscript and printed materials in diverse ancient languages—pose special problems. Arboreal and related web services have been developed for dealing with Latin, ancient Greek, classical Arabic, classical Chinese, and major languages of modern Europe (Italian, German, English, Dutch, French). Collaboration with the Pennsylvania Sumerian Dictionary project has recently added support for Sumerian, and Akkadian is in development; collaboration with the NSF-funded project International Sanskrit Digital Library Collaboration (Brown University, CEDAR/SUNY Buffalo, University of Frankfurt, University of Cologne) will yield support for Sanskrit. Current research aims in adding technologies to deal in addition with the formal languages used in such fields as mathematics, physics, and chemistry.

A Virtual Exhibition as a Medium for Spatially Organizing Knowledge

With the exhibition "Albert Einstein: Chief Engineer of the Universe" in 2005, the Max Planck Institute pioneered, with major financial support from the Heinz Nixdorf Foundation, Siemens, and BASF, a new concept: an "exhibition without walls" (Peter Damerow, Malcolm Hyman). As mentioned above, within the exhibition space of the Kronprinzenpalais were approximately fifty interactive touch-screen-based "media

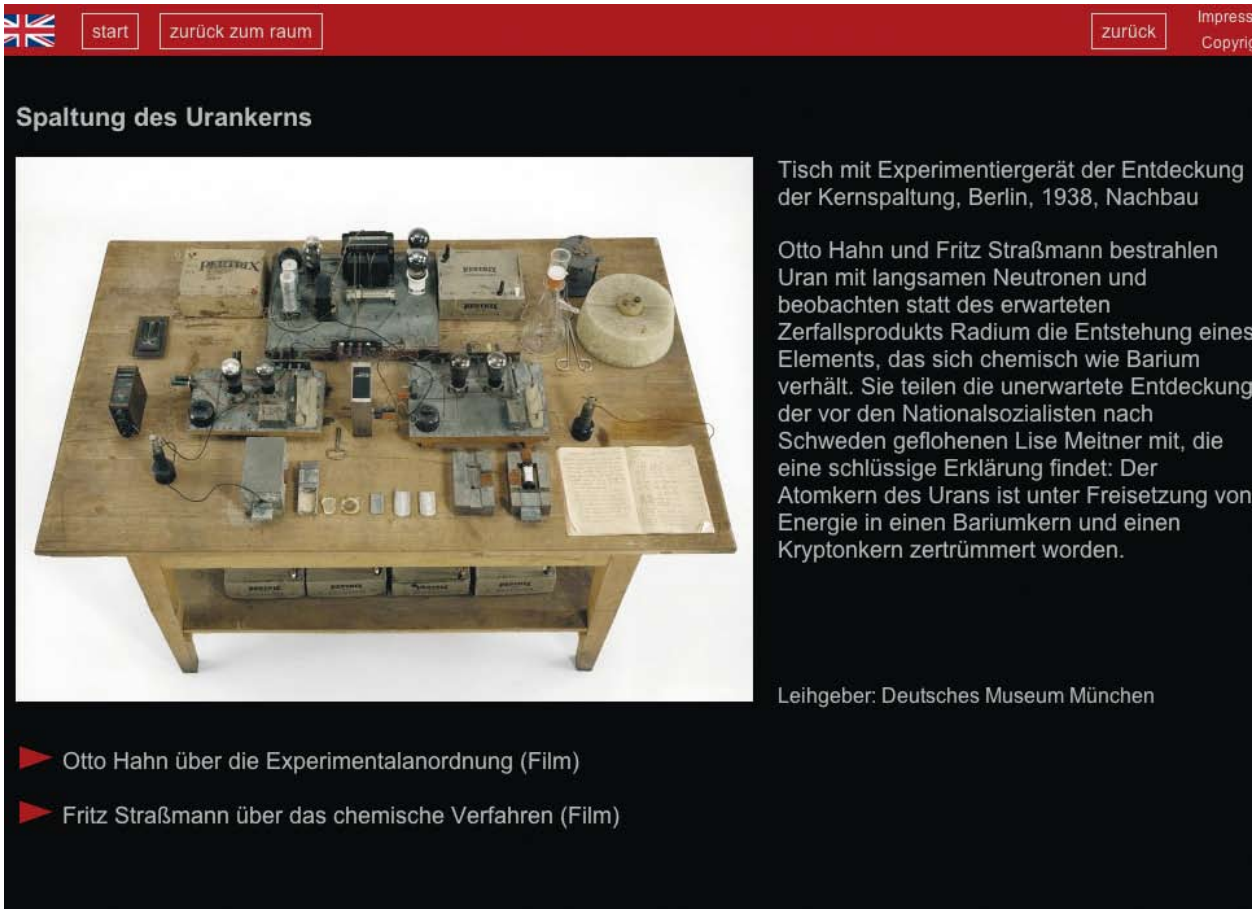
stations." The media stations provided further information on the objects and documents displayed, as well as detailed historical and scientific explanations related to the exhibition content. A number of media stations provided not only interactive content aimed at adult visitors, but also special content targeting children. Rich content available on the stations included video, animations, photographs, drawings, cartoons, scanned documents, text, and external data from the World Wide Web. The media stations brought the larger world of digital media into the Kronprinzenpalais, but at the same time computer servers at the Institute made the content of the exhibition available to a worldwide audience as a virtual exhibition <http://www.einsteinausstellung.de/>. In the virtual exhibition, which is intended to be permanent, visitors can navigate a virtual space corresponding to the exhibition at the Kronprinzenpalais, view photographs of objects and vitrines, explore 3D panoramas of the rooms, and access all the content available on the interactive media stations.

In developing the virtual exhibition, the Institute maintained its strong commitment to Open Access (as articulated in the Berlin Declaration) and the Open Source Software movement. Servers ran an open source operating system (Linux), as well as an open source web application framework (Zope) created in an open source language (Python). Software on the media stations was also entirely open source, including the operating system (Linux) and kiosk-mode browser (Firefox, with modifications by the MPIWG). All software developed by the Institute for both clients and servers is made publicly available under an open source license (Robert Casties, Malcolm Hyman, Dirk Wintergrün).

Fundamental to the design of the virtual exhibition software is the identification of three roles: programmers (individuals who develop and extend the software infrastructure), graphic designers (individuals who develop templates and layouts for information display, with attention to fonts, colors, aesthetics, and perceptual psychology), and content creators (scientists who assemble the multimedia content and compose text). In the virtual exhibition model, these roles are maximally independent. Content creators do not need to be concerned with design or technical implementation issues, and graphic designers do not need detailed knowledge of either the underlying software or the historical/scientific content. Work proceeds in a networked environment where content creators can easily use a web browser to create "slides" with textual content as well as image and video content that is hosted in a shared project-wide web-accessible database. At the same time, designers develop templates that match the general aesthetics of the exhibition; these templates immediately become available for content developed by the scientists and researchers.

Currently the Institute is working with other partners to implement the virtual exhibition model elsewhere. Pilot institutions include the Università degli Studi di Pavia, the Fundación Canaria Orotava de Historia de la Ciencia, and the museum of science (UNIVERSUM) of the National Autonomous University of Mexico (UNAM). As museums and other institutions produce content with the virtual exhibition software, a "virtual world of exhibitions" will emerge, which will truly transcend the barriers of geographic space by making museum and exhibition content anywhere in the world available to any user who sits in front of a computer with a standard web browser. A virtual exhibition, however, may open up an even wider perspective towards new

possibilities of organizing knowledge according to a spatial metaphor, allowing, for instance, information on animals and plants to be placed in the context of a virtual reproduction of their natural habitats, or to situate knowledge on archeological objects in the context of a virtual reproduction of excavation sites, so that such knowledge can be interactively and dynamically accumulated in a way similar to the Wikipedia model.



Media station and part of the virtual Einstein exhibition.

Firole (Pterotrachea sp.),
1809, watercolor on vellum.
Charles-Alexandre Lesueur, from:
Les Vélins de Charles-Alexandre Lesueur, Exposition Catalogue, ed. by Jacqueline Bonnemains, Le Havre 1996, Cat. No. 32

Department II

Ideals and Practices of Rationality

Director: *Lorraine Daston*

Introduction: Towards a History of Rationality

Since it began work in 1995, Department II has explored the history of forms of rationality in the sciences through a series of projects, including "The Varieties of Scientific Experience," "Demonstration, Test, Proof," and "The Scientific Persona." Each project aimed to bring together a diverse group of scholars (junior and senior, from different specialties and national intellectual traditions) to explore a category of scientific thought and practice that was fundamental to the current understanding of rationality. Three premises informed these projects: first, that even the most central features of scientific rationality (such as "fact" or "objectivity" or "demonstration") had evolved historically; second, that their history was best pursued by simultaneously attending to both abstract ideas (e. g. philosophical discourses about evidence) and concrete practices (e. g. how scientific images are made and used); and third, that comparisons among historical periods, cultures, and disciplines were essential to such a history.

These premises, especially the last, have shaped the working methods as well as the topics investigated by Department II. Research projects bring together groups of scholars (approximately twenty-five at any given time) who contribute both by single-authored publications, which examine some specific aspect of the topic in depth, and also by collective ones produced by working groups of three to fifteen members, who meet several times to plan, discuss, and prepare articles or chapters for a joint work. All scholars in residence in Department II meet regularly to present and discuss work-in-progress at the bimonthly departmental colloquium and irregularly in ad hoc reading groups and ongoing conversations about shared research interests. The colloquium follows a workshop format, with pre-circulated papers (in English, French, or German) and designated commentators; approximately two-thirds of the papers are by members of the research group; the remaining third are by guests invited because their work is particularly relevant to the themes of the department's current projects. Moreover, several conferences are organized every year in conjunction with departmental research projects, bringing in additional external participants.

During the period of this *Research Report* (mid–2004 to mid–2006), Department II pursued two major projects, "History of Scientific Observation (2005–8)" and "Knowledge and Belief (2003–5)," as well as two smaller, longer-term research foci, "Between the Natural and Human Sciences" and "Gender Studies of Science." Three other projects were completed: "The Moral Authority of Nature," "Common Languages of Art and Science," and "The Values of Inconsistency." Reports on these projects follow the forms in which research was organized: working groups, conferences, individual participants (a bibliography of publications listed by author's name may be found at the end of this volume). Full descriptions of the individual projects can be found on our website.

Project

History of Scientific Observation

DURATION 2005–2008
MPIWG ORGANIZERS *Lorraine Daston, Kelley Wilder*
COOPERATION PARTNERS Freie Universität Berlin, Germany, Staats- und Universitätsbibliothek Göttingen, Germany

There is no science, natural or human, that does not make use of refined practices of observation to identify and investigate its objects of inquiry. Although almost all forms of scientific observation involve a long and arduous training of the senses, learning to look (or smell or hear) is only the beginning of an apprenticeship. Whether the observation in question is the psycho-physicist's detection of reaction times or the anatomist's mapping of the nervous system, novices are schooled in the use of instruments, the co-ordination of eye and hand, and the making of notes and often sketches. Nor does the observation stop there: it must be forged into a description and often a display. Numerical tables, maps, graphs, and stylized descriptions (as in the case of botany) are all part of the craft of performing, not just preserving an observation. In addition to these tools and techniques, there are sites of observation: the astronomical observatory, the anatomy theater, the meteorological balloon, the field of naturalists and anthropologists, the laboratory of psychologists and chemists, the archives of the historian. The history of scientific observation is in many ways the inverse of that of the casual observation: an accumulation of paraphernalia (the collecting jar, the microscope, the chronometer, the notebook), of experiences (the expedition, the vigil, the dissection, the survey), of techniques (staining a microscope slide, pressing a herbarium specimen, deciphering an old script), and, above all, of habits of attention standardized by discipline—all these acquisitions, both of disciplines as they develop historically and of practitioners as they master their craft, render the scientific observation in the highest degree deliberate and specialized.

→ "Working Knowledge and Science, 1780–1870" p. 145

→ "History and Epistemology of Experimentation" p. 90

The history of scientific observation is in part that of instruments, buildings, and records and in part that of less tangible cognitive practices. Especially in its early stages, forms of scientific observation build upon skills and perceptual acuity acquired in other contexts, including the connoisseurship of natural materials possessed by artisans but also the reading practices of the learned. The efforts of early modern naturalists to attend to and register natural particulars bear, for example, a suggestive resemblance to the philological skills they employed as scholars to digest, excerpt, and recover maxims, quotations, and bits of information they discovered in books; the commonplace book was often the repository for interspersed gleanings from both reading and observation.
Gradually, each scientific discipline acquires a tradition of observation, into which aspiring entomologists or astronomers or historians are initiated; indeed, the double meanings of "discipline" as field of study and molding of mind and body converge

→ "Materials in the History of Science and Technology" p. 127

in this process. To learn to observe scientifically is to learn to see certain objects in a certain way and to care about those objects intensely, often to the exclusion of other, more familiar objects of human concern. The selective concentration and hence distraction of the observer are legendary, as the long line of anecdotes about the absent-mindedness of the learned bear witness, starting with the ancient story of Thales' fall into the well. But the private aspects of scientific observation should not be exaggerated. From the outset, the processes of observation are collective, from the calibrated vision of microscopists to the standardized Latin descriptions of botanists to the uniform instruments of an international geodetic expedition.

Observation in the sciences has not only been practiced but theorized, and in strikingly different ways. Sixteenth- and seventeenth-century philosophers of observation, such as Bernard Palissy, Francis Bacon, and Robert Hooke emphasized the danger, difficulty, and tedium of the task; their eighteenth-century successors in contrast portrayed observation as an all-consuming obsession, pursued to the point of blindness. Starting in the nineteenth century, it became customary to oppose, as Auguste Comte and Claude Bernard did, "active" experiment with "passive" observation, a distinction that was nonetheless constantly blurred in scientific practice and was itself a historical by-product of then-emergent doctrines of objectivity. Certain enduring practices, such as the repetition of observations, have received strikingly different rationales: Enlightenment naturalists recommended repeated observations of the same object or phenomenon because the narrow beam of attention picked out different features each time; twentieth-century philosophers of science asserted that it was a precaution against fraud and error. The histories of the theory and practice of observation have yet to be examined in tandem, or even singly.

The research project on the **History of Scientific Observation** continues Department II's ongoing involvement in the history of scientific experience, most recently in the form of the working group on "Historia in Early Modern Europe" organized in 2003 at the MPIWG by Professor Gianna Pomata (Università di Bologna, Italy) and Professor Nancy Siraisi (Hunter College, New York, U.S.A.); the results of this group were published as Gianna Pomata and Nancy Siraisi, eds., *Historia: Empiricism and Erudition in Early Modern Europe* (Cambridge, Mass./London: MIT Press, 2005).

→ "Historical Styles of Experimentation and Observation: *Historia experimentalis*" p. 136

As in the case of the "Historia" working group, the **History of Scientific Observation** aims to include practices from both the human and natural sciences, albeit in an enlarged historical and geographic framework.

→ "Between the Natural and the Human Sciences" p. 74

History of Scientific Observation
Working Group

An international working group of fifteen scholars held its first meeting at the MPIWG June 27–29, 2006 to plan a collective publication that would trace the fortunes of scientific observation from the late Middle Ages to the twentieth century in the natural and human sciences. Two further meetings are planned, in 2007 and 2008.

Members

- *Domenico Bertoloni-Meli* (University of Indiana at Bloomington, U.S.A.)
- *Charlotte Bigg* (MPIWG)
- *Jimena Canales* (Harvard University, U.S.A.)
- *Lorraine Daston* (MPIWG)
- *Michael Gordin* (Princeton University, U.S.A.)
- *Elizabeth Lunbeck* (Vanderbilt University, U.S.A.)
- *Harro Maas* (Universiteit van Amsterdam, The Netherlands)
- *Andrew Mendelsohn* (Imperial College London, U.K.)
- *Mary Morgan* (London School of Economics, U.K.)
- *Katharine Park* (Harvard University, U.S.A.)
- *Gianna Pomata* (Università di Bologna, Italy)
- *Theodore M. Porter* (University of California at Los Angeles, U.S.A.)
- *Anne Secord* (University of Cambridge, U.K.)
- *Mary Terrall* (University of California at Los Angeles, U.S.A.)
- *Kelley Wilder* (MPIWG)

History of Scientific Observation
Conferences

Observing Nature—Representing Experience. Practices and Concepts 1800–1850, January 28–29, 2005. In collaboration with the DFG Collaborative Research Center "Aesthetic Experience and the Dissolution of Artistic Limits," Freie Universität Berlin, Germany.

ORGANIZER *Erna Fiorentini* (Freie Universität Berlin, Germany/MPIWG)

During the first decades of the nineteenth century, the observation of nature was characterized by a coincidence of the aesthetic and the quantitative. The workshop explored this ambivalence in both art and science, with special attention to the production of images, the individual experience of nature, and the historical relation of observation as simultaneously an act of perception and description. The proceedings will be published in 2007.

Scientific Observation in the Enlightenment, October 13–15, 2005,
Georg-August-Universität Göttingen, Germany
In collaboration with the Staats- und Universitätsbibliothek Göttingen.
ORGANIZERS *Lorraine Daston* (MPIWG), *Joachim Migl* (SUB Göttingen),
Elmar Mittler (SUB Göttingen)

Observation of almost everything imaginable, from alpine glaciers to exotic peoples to microscopic polyps to grain prices, was the primary scientific activity of the Enlightenment. Whether the object of observation was a faintly luminescent diamond, the entrails of a caterpillar, the daily temperature variations registered by the thermometer, or the marriage customs of South Sea islanders, the act of observation was deemed to be the most important and most difficult task of the savant. In an age acutely conscious of the scientific dangers of the *esprit de système*, observations were held up as the most effective antidote to fanciful hypotheses or preconceived ideas. Because observation revealed nature as it was, without laboratory manipulations or controls, it was considered by many Enlightenment savants to be epistemologically superior to experiment. Across a broad spectrum of the natural and human sciences, savants formed themselves into virtuosi of observation, the Enlightenment scientific practice *par excellence*. This international and interdisciplinary conference examined Enlightenment observation from the standpoint of four themes that cut across the particular sciences: tools and techniques, persona, description, and philosophies.

History of Scientific Observation
Planned Conferences

Lay Participation in Scientific Observation, May 31–June 1, 2007.
ORGANIZERS *Susanne B. Keller* (MPIWG), *Jeremy Vetter* (MPIWG/Fairleigh Dickinson University, U.S.A.)

Alexander von Humboldt and Aimé Bonpland in the Plains of Tapia near Mount Chimborazo. Oil on canvas. Friedrich Georg Weitsch, Generalverwaltung Preußischer Schlösser und Gärten Berlin-Brandenburg, Potsdam (Section), around 1810

Tables: The Taking, Making, and Keeping of Data, 2008.
ORGANIZERS *Domenico Bertoloni-Meli* (University of Indiana at Bloomington, U.S.A.), *Lorraine Daston* (MPIWG), *Friedrich Steinle* (Universität Wuppertal, Germany)

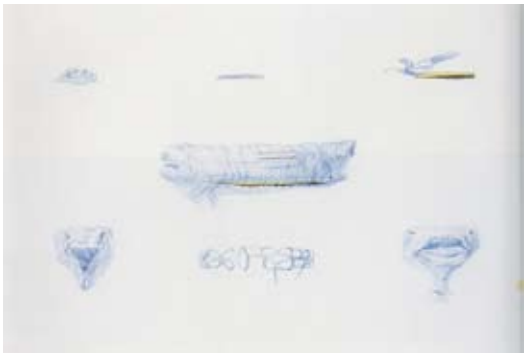
Photography as Evidence, 2008.
ORGANIZER *Kelley Wilder* (MPIWG)

Selbstportrait. Ilse Bing, 1931, Folkwang Museum Essen

History of Scientific Observation
Individual Projects

Jan Altmann (Postdoctoral Fellow, Humboldt-Universität zu Berlin, Germany) explored the functions and effects of drawing as a technique of scientific observation on hand from a series of French case studies, ranging from the early years of the Académie Royale des Sciences in the late seventeenth century to Georges Cuvier's palaeontological investigations in the early nineteenth century. To retrace the correlations between eye, mind, hand, and body, the project penetrates to the material basis of the drawing, the repeated strokes on the textured paper from which the finished (or unfinished) image emerges.

Jan Altmann



Salpe [Cyclosalpa pinnata (Forskål, 1775)]. Watercolor on vellum, 44 x 29 cm. Charles-Alexandre Lesueur, From: *Baudin in Australian Waters: The Artwork of the French Voyage of Discovery to the Southern Lands (1800–1804)*, ed. by Jacqueline Bonnemains et al., Melbourne: Oxford University Press/Australian Academy of the Humanities, 1988 (Cat. No. 75002)

Marie-Noëlle Bourguet (Visiting Scholar, Université de Paris-VII, France) continued her long-term project on the practices of scientific travelers, with a focus on Alexander von Humboldt's notebook from his Italian trip of 1805. Her essay *Écriture du voyage et construction savante du monde. Le carnet d'Italie d'Alexander von Humboldt* appeared as MPIWG Preprint no. 266; her book will be published in 2007.

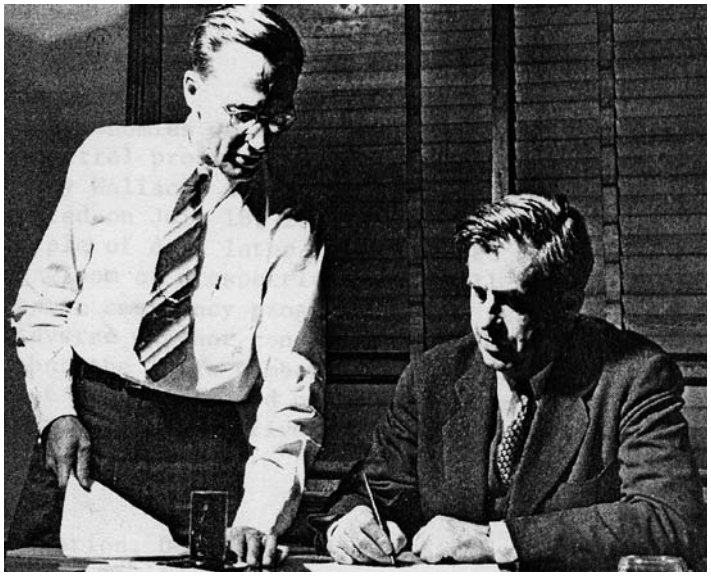
Brita Brenna

Brita Brenna (Postdoctoral Fellow, Universitetet i Oslo, Norway), with the support of the Centre for Technology, Innovation and Culture at the University of Oslo, Norway, studied how Norwegian nature became an object of scientific inquiry, theological contemplation, economic resources, and political significance, with special attention to Erich Pontoppidan's two-volume *The First Attempt at a Natural History of Norway* (1752–53).

Lorraine Daston (MPIWG, Director) and Peter Galison (Harvard University, U.S.A.) completed their book *Objectivity* (Zone Books, 2007), which traces the history of epistemic virtues such as truth, objectivity, and judgment on hand from the practices of scientific image-making from the eighteenth to the early twenty-first centuries. Continuing work on the history of observation and attention included in this book and in earlier publications, she has begun an inquiry into the relationship between economies of attention and the cultivation of the scientific self among Enlightenment naturalists.

Cirrocumulus stratiformis lacunosus. International Cloud Atlas, Vol. 2, Geneva, 1987, p. 118

Emmanuel Didier (Visiting Scholar, Centre National de Recherche Scientifique, France) completed work on his book on the huge growth of statistical surveys as a form of mass observation in the United States during the interwar period: *Comment les sondages ont exprimé l'Amérique. Une histoire des enquêtes partielles aux Etats-Unis l'Entre-deux-guerre* (INED Press). At the center of the study stands the new method of random sampling, which in turn led to new ways of defining and governing the nation that made the New Deal possible.



Federal Secretary of Agriculture, Henry A. Wallace, signing a statistical crop report. Courtesy National Agricultural Statistical Service, US Department of Agriculture, in the 1930's

Christelle Gramaglia (Predoctoral Fellow, École des Mines, Paris, France) completed her ethnographic research on how ecotoxicologists in France and Germany use "sentinel organisms" to detect water pollution. These new observational instruments enroll living organisms into research protocols and offer evidence on the impact of pollutants on organisms and environments that is more immediately connected to the experience of laypeople and professionals (e.g. fishermen) than more conventional forms of scientific data.

Christelle Gramaglia

River sentinel / mollusk *Corbicula Fluminae.* J.-C. Massabuau, LEESA.

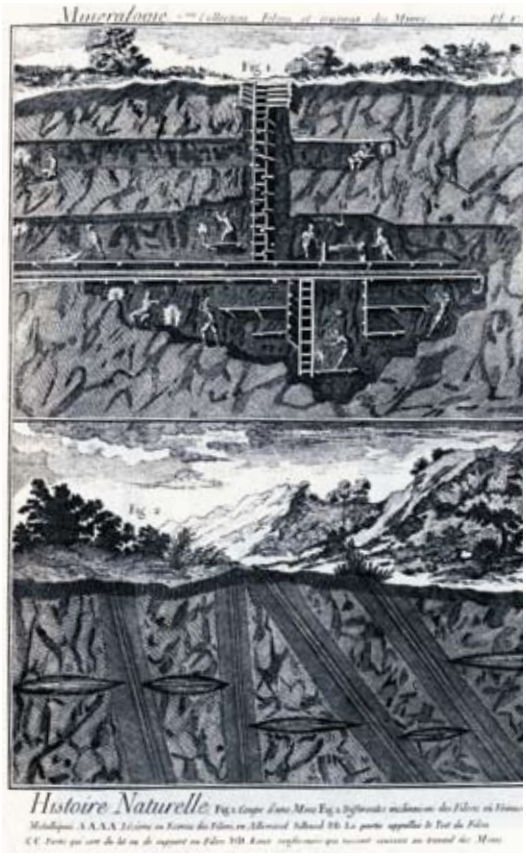
Erna Fiorentini

Erna Fiorentini (Visiting Scholar, Freie Universität Berlin, Germany/MPIWG) examined the role of optical instruments, especially the camera lucida, in the practices of early nineteenth-century scientific observation. Impressed by new discoveries in sensory physiology, these observers could no longer view the eye as a passive screen upon which external reality was projected; they instead attempted to develop the perceptual and epistemic capacities of the eye. Observation and depiction carried out by means of the camera lucida combine objective cogition and subjective judgment, selection, and creation.

Reverend Calvert Jones (?) sketching with a Wollaston camera lucida (probably a self-portrait done in a mirror). Pencil camera lucida drawing. The National Library of Wales, ca. 1830

Susanne B. Keller

Susanne B. Keller (Postdoctoral Fellow, Universität Hamburg, Germany) investigated the visualization of the hidden zone's beneath the earth's surface, from the eighteenth through the twentieth centuries. A major focus of the project is the word-image relationship in illustrated scientific treatises. Questions include: What can be deduced from the surface? What concept of observation does this involve? What is the epistemic value of fragmentary visual information for an understanding of the whole?

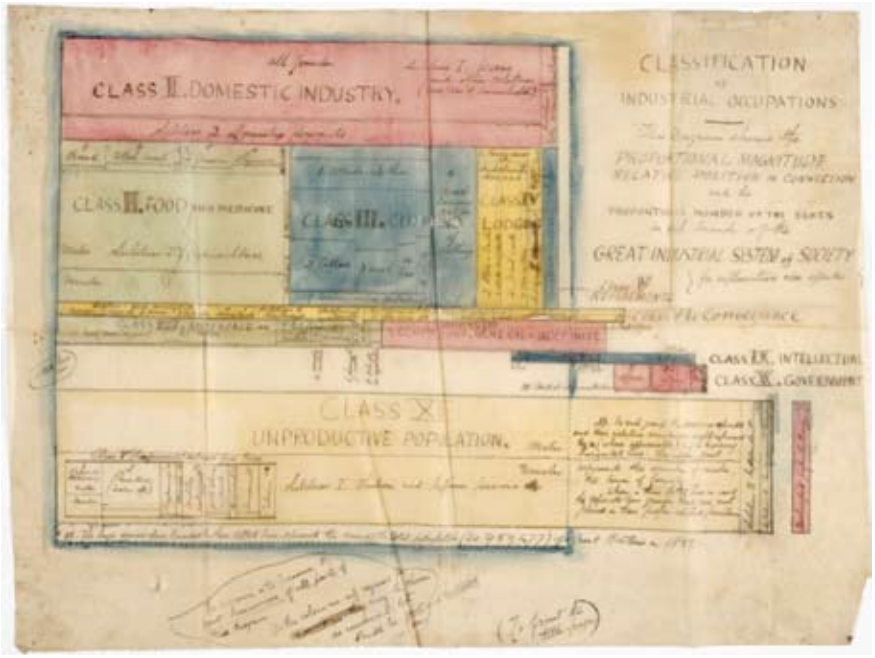


Recueil des Planches, Minéralogie, 7me collection, Filons et travaux des Mines, Diderot & Jean Le Rond d'Alembert, *Encyclopédie ou Dictionnaire raisonnée des sciences, des Arts et des Métiers*, Paris 1751–1780 (MPIWG, Library)

Rhodri Lewis

Rhodri Lewis (Postdoctoral Fellow, University of Oxford, U.K.) studied the reception and development of the classic arts of memory (mnemotechnics) in Northern Europe, ca. 1500–1700, especially the way in which mnemotechnics were approached as a set of tools through which one might accurately represent, and think about, the natural world. As the preface of Robert Hooke's *Micrographia* suggested, memory was one of the internal senses, and if an external sense such as vision could be remedied with eyeglasses, telescopes, or microscopes, then it might be possible to augment the function of memory in a similar way. His book *Language, Mind and Nature: Artificial Languages in England, Bacon to Locke*, is forthcoming from Cambridge University Press.

Harro Maas (Visiting Scholar, Universiteit van Amsterdam, The Netherlands) explored introspection as a mode of observing and theorizing the social world in the context of political economy in the nineteenth and twentieth centuries. Starting with studies of the slave economy of the American South in the 1860s, he follows how mechanical analogies and statistical data came to replace introspection as a mode of empiricism in economics.



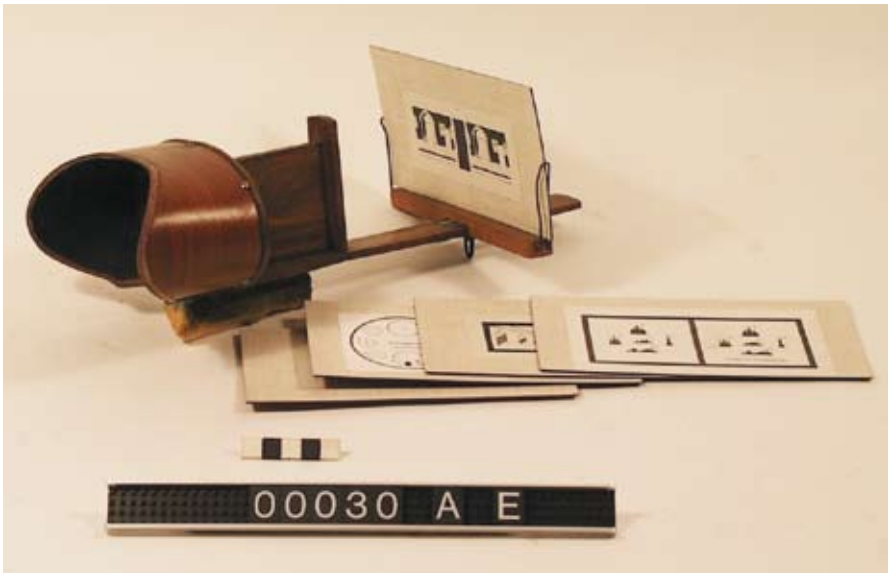
Stratigraph of industrial activities of the young Stanley Jevons (and later political economist) based on a hierarchy of human needs. Stanley Jevons' papers, John Ryland, Library, Manchester, around 1855

Susanne Pickert

Susanne Pickert (Predoctoral Fellow, Humboldt-Universität zu Berlin, Germany) examined pre-modern observation in the travelogues of high and late medieval pilgrimages to the Holy Land, focusing on the motivation for detailed observation and description as well as the means of communicating them. To bolster the perceived reliability of their accounts and the clarity of their descriptions, authors applied contemporary concepts of trustworthiness and textual organization. These specifically medieval observation practices were embedded in the topography of Christian remembrance.

Thomas Sturm

Thomas Sturm (Lorenz Krüger Postdoctoral Fellow, Universität Marburg, Germany) pursued a project on how the psychology of perception treated sensory illusions, a topic of enduring interest in optics and astronomy as well as psychology and philosophy. The study attempts to combine a material history of scientific instruments (e. g. Wheatstone's stereoscope of the 1830s) with a history of the methodological and theoretical assumptions that guided psychological investigation of sensory illusions. His essay "The Role of Instruments in Psychological Research" (co-author: Mitchell Ash) was named best article in the journal *History of Psychology* in 2005.



Wheastone-Stereoscope for the simulation of depth perception. Institute for the History of Psychology, Universität Passau

Margareta Tillberg

Margareta Tillberg (Visiting Scholar, Växjö universitet, Sweden), with the support of the Swedish Research Council, investigated the influence and significance of artists' observational techniques on the sciences in one of the major research institutes of the Soviet Union, the All-Union Scientific Research Institute of Industrial Design (VNIITE, established in Moscow in 1962). In an attempt to invent new design methods for the Soviet planned economy, VNIITE came to employ some 10,000 artists, engineers, architects, mathematicians, physiologists, and economists in multi-disciplinary research groups in a vast collaboration of artistic and scientific observation.

Danny Trom

Danny Trom (Visiting Scholar, Centre National de Recherche Scientifique, France) studied how German landscapes became an object of public interest (and concern, as potentially endangered) in the late nineteenth century. This shift was less the result of new knowledge or new techniques of visualization than of the collection and redeployment of extant but dispersed knowledge, know-how, and administrative methods to observe, count, and manage landscapes. Scientists especially were called upon by political authorities to define landscape as an objective category, independent of subjective perspective.

Jeremy Vetter (Postdoctoral Fellow, University of Pennsylvania, U.S.A.) investigated the region as a useful scale for analyzing the environmental context and work organization of science, focusing on field work between 1860 and 1920 in the United States Great Plains and Rocky Mountains. Modes of field production differed from their laboratory counterparts in seeking a middle ground between the epistemological authority of universality and the practical usefulness of relating to particular regional and local environments and cultures.

Jeremy Vetter

Harold J. Cook, Agate fossil quarry, 1922 Item 5912.112, Box G, Cook Photograph Collection, Agate Fossil Beds National Monument, Harrison, Nebraska, U.S.A.

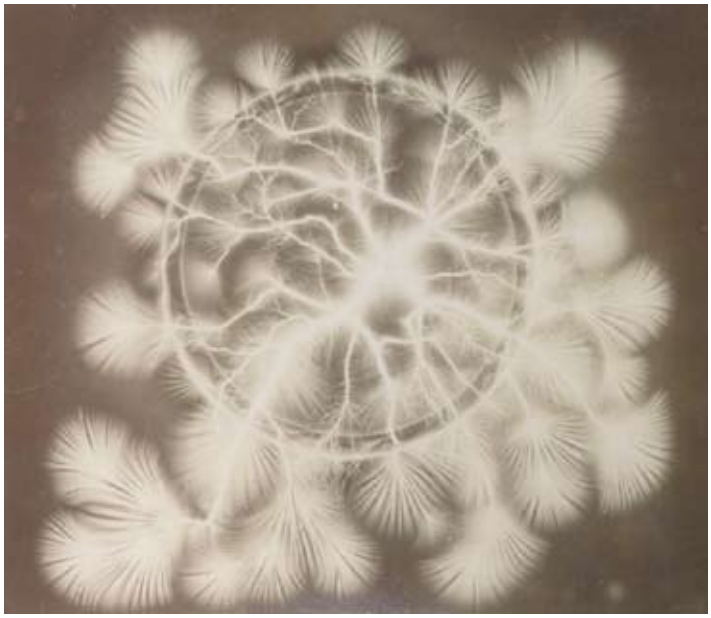
Marga Vicedo-Castello (Postdoctoral Fellow, Harvard University, U.S.A.) examined the methods used by early ethologists Niko Tinbergen and Konrad Lorenz to study many different animal species in natural environments, as opposed to the "artificial" setting of the laboratory, as well as their debates with comparative psychologists T. C. Schneirla and D. S. Lehman. Observational tools such as the movie camera, but also observational stances such as subjective identification with the animals figured prominently in these discussions. This study is part of a larger book project on the history of scientific ideas about maternal care and love in the nineteenth and twentieth centuries.

Marga Vicedo-Castello

Konrad Lorenz followed by his imprinted geese. Niko Tinbergen, around 1938

Kelley Wilder

Kelley Wilder (Research Scholar) began a project on the nature of photographic evidence in science. By the late nineteenth century, the photochemical trace (including photography) was providing scientists with innumerable insights into the natural world: photography recorded things that were too small, too fast, too far way, too ephemeral, or invisible to the human eye. The project examines not only how photography was used in the sciences, but also how photography came to be surrounded by the language and rhetoric of science.



Décharge électrique dans un environnement chargé de dioxyde de carbonne, aristotype, 17,7 cm x 23 cm. Stéphane Leduc, Université de Nantes, Section Santé, around 1890 From Denis Canguilhem, *Le merveilleux scientifique. Photographies du monde savant en France*, 1844–1918, (Gallimard) Paris 2004, p. 110.

Rafael Ziegler

Rafael Ziegler (Predoctoral Fellow, McGill University, Canada), with support from the Canadian Social Science and Humanities Research Council and a McGill Department of Philosophy Dissertation Fellowship, studied the interaction of statistical rationality and the normative demands of an individualist, Kantian ethic on hand from two case studies: the concept of "eco-space" proposed by economists and civil society actors in the 1980s as a way to operationalize sustainable development; and Pareto's 1896 large-scale study of personal income distribution.

Project

Knowledge and Belief

DURATION 2003–2006
MPIWG ORGANIZERS *Lorraine Daston, Bernhard Kleeberg, Fernando Vidal*
COOPERATION PARTNER Princeton University, U.S.A.

It is a revealing fact that nine out of ten historians of science immediately translate the phrase "Knowledge and Belief" into "Science and Religion." Although a great deal of history, philosophy, and sociology of science of the past forty years has been concerned with how scientific beliefs are turned into scientific knowledge (or vice versa), conjectures into proofs, heterodoxy into consensus, the problem remains conceptualized as (take your pick) the war between, the peaceful coexistence of, the mutual embrace of science and religion. Moreover, "religion" is overwhelmingly taken to refer to Christianity, indeed more narrowly to Protestantism. The primary aim of this project was to reconfigure the terms in which problems of knowledge and belief are discussed within the history of science.

The precondition for such a reconfiguration is more breadth and comparison among the topics considered under the rubric "knowledge and belief:"

1 A wider disciplinary view: As in the rest of the history of science, the focus of most historiography has been on the natural sciences, and on the natural sciences as constituted disciplines (e. g. history of physics, history of biology, etc.). This approach may make sense for some sciences with ancient roots and continuous traditions (e. g. astronomy), but in most cases, the formation of disciplines as intellectual and institutional entities is a nineteenth-century phenomenon. Moreover, classifications of knowledge change over time, and fields now remote (e. g. philology and biology, or music and mathematics) have earlier in their histories been close neighbors. Until the late eighteenth century (and later in some locales) patterns of education and practice tended to promote considerable connectivity among scholarly and scientific fields. In the case of knowledge and belief, there were significant interactions between what are now known as the humanities and the natural sciences about key issues of evidence and proof: e. g. the discussions about the reliability of witness testimony conducted by historians, jurists, theologians, and natural philosophers in early modern Europe (see reports by *Baár*, *Lehmann-Brauns*, and *Perinetti*, below). These were discussions of considerable practical as well as intellectual import: royal successions were legitimated, saints canonized, and experiments validated on the basis of testimony. This is why the research group included members with backgrounds in literature, history, art history, and philosophy as well as history of science proper.

2 A wider cultural and chronological view: This is especially important for the traditional core of the study of knowledge and belief in the history of science, viz. science and religion. Two foci of the project attempted to address this desid-

→ "Mental Models in the History of Mechanics" p. 21

eratum. One compares the reception of ancient natural philosophy and mixed mathematics in Islam, Judaism, and Christianity. Despite the continuing sociological (and now, alas, political) interest in the relationship between religion and modernization (especially with respect to science and technology) since Max Weber, there is astonishingly little detailed comparative research on the topic. What detailed research exists on, say, science and Islam is rarely brought into sustained dialogue with analogous research for other cultures and confessions. The other focus looks at the development and uses of natural theology from the Middle Ages through the nineteenth century. Here the problem has been an undifferentiated lumping together of arguments from design from Aquinas through Darwin with scant attention to dramatically altered intellectual and cultural contexts.

3 A wider set of questions and ways of answering them: The methods as well as the topics of inquiry into scientific knowledge and belief have heretofore been narrowly conceived. Within studies of science and religion, the chief questions and sources are doctrinal, comparing, e. g., the content of religious articles of faith with that of evolutionary theory. Within knowledge and belief more generally construed, most attention has also been directed to knowledge and belief understood as propositions (e. g. the tenets of phlogiston theory vs. those of Lavoisier's chemistry), with some supplementary interest in evidentiary questions as to how the tenets of one or another scientific hypothesis are proven against its rivals. In the past decade, historians of science have explored the practices as well as the texts of science, but this approach has thus far made little headway into the study of knowledge and belief. The third focus of the research project was to open up new questions (e. g. the epistemological status of dreams: see reports by *Campbell, Gantet,* and *Schirrmeister,* below) and new approaches (e. g. the role of the visual in creating, sustaining, and standardizing belief: see report by *Kusukawa,* below). The aim is to modify the meanings of knowledge and belief themselves, understood as epistemological practices as well as propositions assented to.

Knowledge and Belief

Working Groups

Three working groups were formed to address these foci on hand from specific research projects: Before the Revolutions: The Fifteenth Century; Natural Theology; and Epistemology of Belief. Each group met several times at the MPIWG in the course of the project; all three groups came together in common sessions to discuss general issues related to the project and to report on specific work done by each group; some individual members of each group were resident for longer periods at the MPIWG as Visiting Scholars.

Before the Revolutions: The Fifteenth Century.

MEMBERS *Rivka Feldhay* (Tel Aviv University, Israel), *Jamil Ragep* (University of Oklahoma, U.S.A.), *Wilhelm Schmidt-Biggemann* (Freie Universität Berlin, Germany).

The fifteenth century witnessed major political, religious, and intellectual upheavals that shook authority throughout Europe and the Near East: the fall of Constantinople, the voyages of exploration to the Far East and Far West, the expulsions of Arabs and Jews from Spain, the advent of printing, religious schisms, the rise of humanism and critical historical methods. The working group addressed the impact of these changes on the realignment of the sciences, focusing especially on astronomy, philology, and mathematics in Christian, Jewish, and Islamic contexts. Special attention was paid to cultural relocation resulting from imperial expansion, religious expulsion, travel, and diplomacy, all of which massively influenced scholarly contacts during this period. The working group organized a conference, "Before the Revolutions: Religions, Sciences, and Politics in the Fifteenth Century," held January 13–15, 2005 at the MPIWG (see *Conferences*, below). A new working group, drawn largely from participants in the conference, will pursue the issues it defined in the context of pre-Copernican astronomy (see *Upcoming Activities*, below).

Natural Theology.

MEMBERS *Rivka Feldhay* (Tel Aviv University, Israel), *Bernhard Kleeberg* (MPIWG), *Scott Mandelbrote* (University of Cambridge, U.K.), *Joan L. Richards* (Brown University, U.S.A.), *Laura Smoller* (University of Arkansas at Little Rock, U.S.A.), *Fernando Vidal* (MPIWG).

Natural theology (or "physicotheology," as it was also known in the early modern period) has traditionally been the primary area for discussion of knowledge and belief within the historiography of science. In the tradition of Christianity, natural theology was understood as the demonstration of God's existence and attributes from the "book of nature" (as opposed to the book of scripture) or from human reason (as opposed to revelation). Although natural theology was most influential in the sciences from the seventeenth through the early nineteenth centuries, its intellectual lineage can be traced back to the Middle Ages and forward to the present. The working group developed a framework for a collection of articles (submitted as a thematic issue of

the journal *Science in Context*) that deliberately reversed the usual historiographic pairings of knowledge with nature and belief with God: "Believing Nature, Knowing God." On the one hand, knowledge of nature presupposes a moral, emotional, and cognitive attitude of belief in certain epistemic values, in the procedures associated with them, and in the results to which they lead. On the other, natural theological claims about God entail evidentiary and argumentative practices of the sort used to produce knowledge. The articles written by the members of the working group, which span the fourteenth through the nineteenth centuries, aimed to historicize the concepts of knowledge and belief, as well to track the shifting boundary (sometimes blurred) between science and religion.

Table of Contents

Epistemology of Belief.

MEMBERS *Mary Baine Campbell* (Brandeis University, U.S.A.), *Lorraine Daston* (MPIWG), *Arnold I. Davidson* (University of Chicago, U.S.A.), *John Forrester* (University of Cambridge, U.K.), *Simon Goldhill* (University of Cambridge, U.K.).

Epistemological approaches to knowledge and belief are tightly intertwined with questions of evidence, proof, demonstration, confirmation and falsification—all the ways in which beliefs can be probed and tested before they are promoted to the status of knowledge. The standard model assumes that knowledge and belief are related to one another as points along a continuum (or probability values ranging from zero to one). This model implies that knowledge and belief are in most cases fungible: a belief may be promoted to knowledge; erstwhile knowledge may be demoted to belief. According to the standard model, moreover, both knowledge and belief must be formulated as propositions to which one assents or dissents. Ideally, the model demands that these propositions be submitted to the bar of evidence, and it is on this basis that they are to be positioned on the knowledge-belief continuum. None of the features of this standard model are self-evident and many are contested. Historians, philosophers, and sociologists of both religion and science have repeatedly pointed out how poorly the model corresponds to actual practice—and approved practice at that. In the case of science, the rigorous implementation of the model would bring

the whole enterprise to a standstill. Much experimental and even theoretical knowledge is tacit rather than propositional; the division of intellectual labor and the transmission of knowledge depend on trust in colleagues and deference to teachers; even mathematicians do not insist on personally reproving all theorems before accepting them as knowledge. Philosophers (and scientists themselves) fret about how to reconcile the short lifespan of scientific theories, the to-and-fro movement along the knowledge-belief continuum, with ideals of eternal and immutable truth. So how did the standard model become standard and why does it endure? The aim of the working group was to trace a history of the standard model, criticize its empirical adequacy (especially as an account of knowledge), and outline a possible alternative model that does justice to actual scientific and scholarly practices. The result was a jointly authored article, "Rethinking Knowledge and Belief," accepted by the journal *Common Knowledge*.

Knowledge and Belief
Conferences

Miracles as Epistemic Things, October 29–30, 2004.
ORGANIZER *Fernando Vidal* (MPIWG)

Drawing inspiration from Hans-Jörg Rheinberger's concept of "epistemic things" (entities and processes, such as physical structures, chemical reactions or biological functions, characterized, in the context of experimental systems, by the fact that they embody what one does not yet know), the workshop aimed to approach miracles as exemplary objects of both belief and knowledge, to bring miracle-making into the purview of the history of science broadly conceived, and to explore the theme beyond the usual historiographic rubric of "science and religion" and the well-studied 17th- and 18th-century debates on the epistemological and material possibility of miracles. A book based on the conference, edited by Fernando Vidal, has been submitted to Brill for publication.

Table of Contents

to be continued

Table of Contents (Continuation)

Before the Revolutions: Religions, Sciences, and Politics in the Fifteenth Century, January 13–15, 2005.

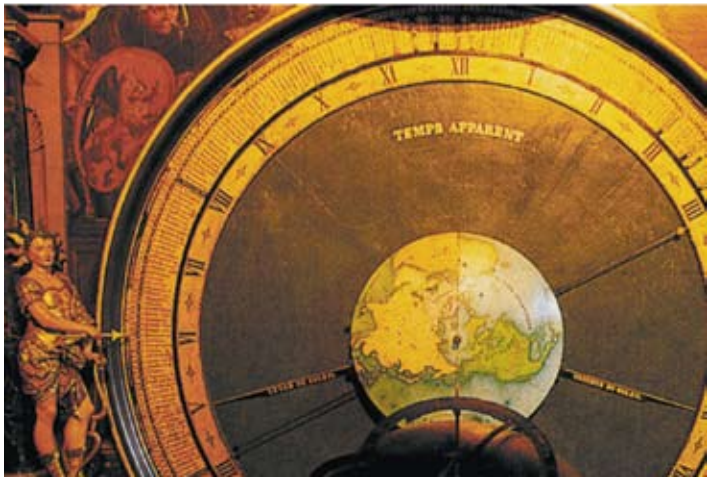
ORGANIZERS *Rivka Feldhay* (Tel Aviv University, Israel), *Jamil Ragep* (University of Oklahoma, U.S.A.), *Wilhelm Schmidt-Biggemann* (Freie Universität Berlin, Germany)

The conference expanded historical perspectives on fifteenth-century intellectual history to embrace expulsions and migrations outside or on the margins of Europe and developments in all three monotheistic religions on the eve of modernity. Within this more capacious framework, five topics were singled out for special attention: the realignment of the sciences; philology—speculative, critical, and historical; cultural relocation and reidentification; eschatology and prophecy; and the questioning of authority and the consolidation of diversity.

Cosmographia. Claudius Ptolemäus, Weltkarten, Reprint, Edition Georg Popp, Würzburg 1977, Table I (section)

The Destruction of Biblical Chronology between Scaliger and Vico,
August 24–26, 2005.
ORGANIZERS *Anthony Grafton* (Princeton University, U.S.A.), *Sicco Lehmann-Brauns* (MPIWG); in collaboration with the Department of History, Princeton University, and the Andrew W. Mellon Foundation.

During the early modern period, scholars turned new intellectual tools on the traditional chronology of biblical exegesis and universal history. Theological, philological, historical, geological, and astronomical analyses lengthened the timeline step-by-step. New models of universal history rejected the narrow focus on the bible and embraced Chinese and Indian sources. The result was not only the discovery of "deep time," as Italian historian Paolo Rossi has called it, but also new explanations of the development of the earth and of human civilization. The proceedings of the workshop will be published in the *Journal of the History of Ideas*.



Astronomical Clock, Strasbourg Cathedral, from: Phillipe Legin, *Die astronomische Uhr in Bildern*, Colmar 1982

Knowledge and Belief
Individual Projects

Monika Baár (Postdoctoral Fellow, University of Oxford, U.K.) pursued two projects, both concerned with historiography: how nineteenth-century Central European historians attempted to reconcile scholarly standards with nationalist aspirations (the book manuscript *Historians and the Nation in the 19th Century: The Case of East-Central Europe* has been accepted for publication in the Oxford Historical Monographs series); and the role of fiction in history writing during the Romantic period, especially how forgeries and pieces of literature were incorporated into the historical record.

Mary Baine Campbell (Visiting Scholar, Brandeis University, U.S.A.) investigated how dreams were theorized in early modern France and England, societies in the throes of profound cultural revolutions. She plans a book on how dreams came to be excluded from knowledge, including chapters on the fate of metaphor, the dreams of early modern mathematicians, the anthropological displacement of dream activity onto the New World and peasant cultures, and the development of an "oneiric private sphere" in which dream speaks only of private feeling, no longer of privileged access to knowledge.

Rivka Feldhay

Rivka Feldhay (Visiting Scholar, Tel Aviv University, Israel) continued work on a book about Jesuit science and cultural fields in early modern Europe. She addressed three main questions: how Jesuits attempted to reconstrue the meanings of science and faith in the sixteenth and seventeenth centuries, using the concepts of Thomist theology but in a context shaped by Reformation- Counter-Reformation polemics; the efforts of Jesuit mathematicians to justify the scientific claims of mathematical disciplines vis-à-vis both natural philosophy and theology; and science teaching in Jesuit schools.

Claire Gantet (Postdoctoral Fellow, Université de Paris I, France) researched a book on the debate about the origins and significance of dreams in the Holy Roman Empire, ca. 1500–1750. Dreams alleged to come directly from divine sources circumvented the established churches and therefore represented a potential danger to the authorities. Gradually, dreams were transferred from the province of the theologian to that of the physician, expressions of pathological beliefs rather than revelation. The book will examine how the epistemological (as well as the cultural and political) status of dreams shifted as truth was progressively defined in terms of facts by the late seventeenth century.

Hannah Ginsborg (Visiting Scholar, University of California at Berkeley, U.S.A.) completed three articles and revised a fourth, all part of an ongoing exploration of the normativity of nature: empirical concepts, aesthetic experience, and teleology in Kant's *Critique of Judgment.* This distinctive kind of normativity is exemplified paradigmatically in judgments of beauty, but is also at work in the activities of classification and discrimination through which concepts are acquired, and it is indirectly applied in the understanding of the biological world.

Don Handelman (Visiting Scholar, The Hebrew University of Jerusalem, Israel) continued a project on how many of the ordinarily transient micro-structures of everyday action can be stabilized as rituals, which often develop greater complexity, self-reproducibility, and permanence. The intention is to formulate many of the micro-practices of both everyday life and ritual as non-reducible to individual agency, with special attention to the bureaucratic logic of modern social orders.

Sarah Tindal Kareem (Postdoctoral Fellow, Harvard University, U.S.A.) explored the willing suspension of disbelief in eighteenth-century fiction. Early novelists, including Behn and Defoe, adopt a "strange but true" formula that encourages a twofold wonder in which the reader credulously marvels at the strangeness and at the same time wonders skeptically at the truth-value of the events related. Once the novel makes explicit its fictional nature, the response of wonder transmutes into willing suspension of disbelief, combining reader-responses that draw on the popular lore of wonder and on Enlightenment skepticism.

Bernhard Kleeberg (Research Scholar) studied the emergence and transformations of the concept of raising the standard of living in the eighteenth and nineteenth centuries in between different fields of knowledge (economic theory, moral philosophy, social statistics) as well as political and social practices. Since the mid-eighteenth century developmental thought and tendencies toward standardization and normalization made general progress conceivable, contradicting older cyclical theories of wealth. Yet, political measures to raise the standards were only taken up slowly, since they were mainly defined in moral terms—as provident behavior. Besides preparing publications he co-organized an HSS-session and a conference on the topic. In addition, he has been working on natural aesthetics and theology. In 2005 his study on Ernst Haeckel was published that served as a basis for his work in the working group on natural theology.

Bernhard Kleeberg

Sachiko Kusukawa (Visiting Scholar, University of Cambridge, U.K.) pursued a book project on the use of pictures in scholarly studies in the Renaissance, particularly the double role of pictures as proof and persuasion in botany and anatomy. Pictures simultaneously established new knowledge of nature and persuaded audiences to form "fides oculata." During her stay at the MPIWG, she focused her research on Swiss botanist Conrad Gesner's use of images in the making of knowledge.

Historia plantarum. Conradi Gesneri, Aquarelle aus dem botanischen Nachlass von Conrad Gessner (1516–1565) in der Universitätsbibliothek Erlangen, Faksimile Edition, ed. by Heinrich Zoller et. al., Zürich: Urs Graf (1972–1980), Vol. 1, Table 25

Laurent Loty (Visiting Scholar, Université Rennes II, France) undertook research in the archives of the Berlin-Brandenburgische Akademie der Wissenschaften on the 1753 debate sponsored by the Akademie on optimism, a political philosophy of submission in the Enlightenment: if we already live in the best of all possible worlds, what is the point of reforms? This manuscript study contributed to an ongoing project on the Enlightenment political imagination, especially the role of utopias.

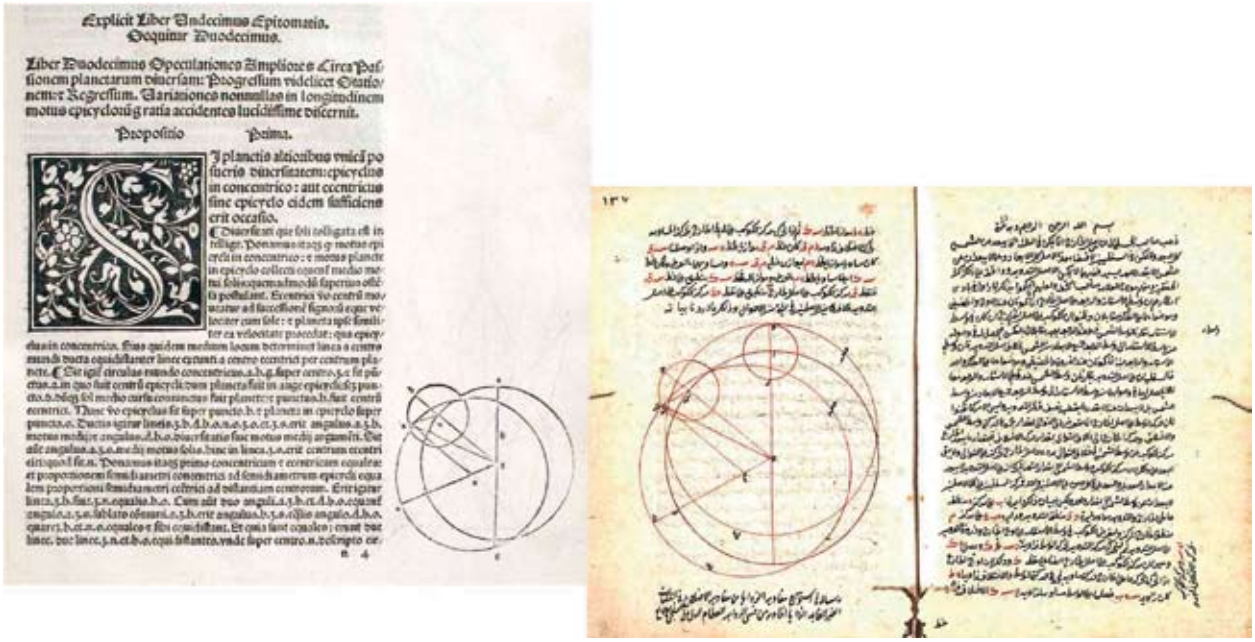
Scott Mandelbrote (Visiting Scholar, University of Cambridge, U.K.) prepared several articles on the uses of early modern natural theology and also on the reception of Isaac Newton's writings (the subject of two conferences he has co-organized for 2006 and 2007). He also completed an article on the scientific and medical libraries of early modern Britain, which appeared in the MPIWG Preprint Series in 2005.

Sicco Lehmann-Brauns (Postdoctoral Fellow, Freie Universität Berlin, Germany) analyzed eighteenth-century methods used to examine the fringes of history, both the remote past of prehistory and the remote future end of history. These methods evolved in the context of a transition from biblical chronology to new dating systems based on new kinds of evidence—philological, antiquarian, astronomical. Interest in the beginning and endpoints of history spawned a new discipline: the philosophy of history.

Dario Perinetti (Visiting Scholar, Université du Québec à Montréal, Canada) examined how early modern debates on the nature of historical knowledge triggered sustained philosophical reflection on how testimony-based beliefs are formed and can be justified. Two articles resulted: "Moral Certainty and Empirical Knowledge in the Early Modern Period," and "History and Logic in the Eighteenth Century." Both will eventually also form chapters of a book on *Philosophical Reflection on the History in the Enlightenment.*

Portrait of Menasseh ben Israel, engraving. Salom Italia, Courtesy of Rijksmuseum Amsterdam, ca. 1642

Sina Rauschenbach (Visiting Scholar, Martin-Luther-Universität Halle-Wittenberg, Germany) explored knowledge and intercultural exchange in seventeenth-century Judaism on hand from the career of Menasse ben Israel (1604–1657), who won the respect and friendship of prominent Christian members of the Republic of Letters and who served as a mediator between Christianity and Judaism. This research is part of a larger project on the early modern intellectual.



Comparison of diagrams. Left: J. Regiomontanus and G. Peurbach, *Epytoma joannis in monte region in almagestum ptolemaei*, Venice 1496; Right: Ali Qushji, *Fi anna asl al khari*, Carullah, MS 2060, f. 137a. History of Science Collections, University of Oklahoma Libraries; Süleymaniye Library, Istanbul

Jamil Ragep (Visiting Scholar, University of Oklahoma, U.S.A.) continued work on the relationships between Islamic astronomers to their early modern European counterparts, especially Copernicus. Two articles resulted from this research, one of which, "Copernicus and His Islamic Predecessors," will be republished in the *Journal for History of Astronomy* in 2007 at the editor's request in order to reach a wider audience. He also launched, with Sally Ragep, the Islamic Scientific Manuscript Initiative (see *Upcoming Events*, below), which is supported by the MPIWG IT group.

Joan L. Richards (Visiting Scholar, Brown University, U.S.A.) investigated knowing and believing as defined and lived by several generations of an English family in the late eighteenth and nineteenth centuries: the Frend-De Morgan family. The successive generations of this family wrestled with the meaning of reason for mathematics, religion, politics, spiritualism, and the family. Although family traditions were creatively adapted to changed historical circumstances, the commitment to the unity of knowing and believing remained firm.

Albert Schirrmeister (Postdoctoral Fellow, Universität Bielefeld, Germany) investigated dreams and knowledge in early modern societies with attention to the changing legitimation of dreams as knowledge, using examples drawn from the work of Michel de Montaigne (1533–1592), René Descartes (1596–1650), and Blaise Pascal (1623–1662). The blurred boundary between daydreaming and nocturnal dreams opened up the possibility of fusing the traditional prophetic and visionary authority of dreams with the new individual, more corporeal account of dreams, as in meditations.

Mark Seltzer (Visiting Scholar, University of California at Los Angeles, U.S.A.) explored models of mass public belief and scientific truth via the matter of modern crime in the nineteenth and twentieth centuries. "True crime" is the crime fact that looks like crime fiction, inhabiting a twilight zone between reality and fiction created by the modern mass media. The book True Crime will be published by Routledge in fall 2006.

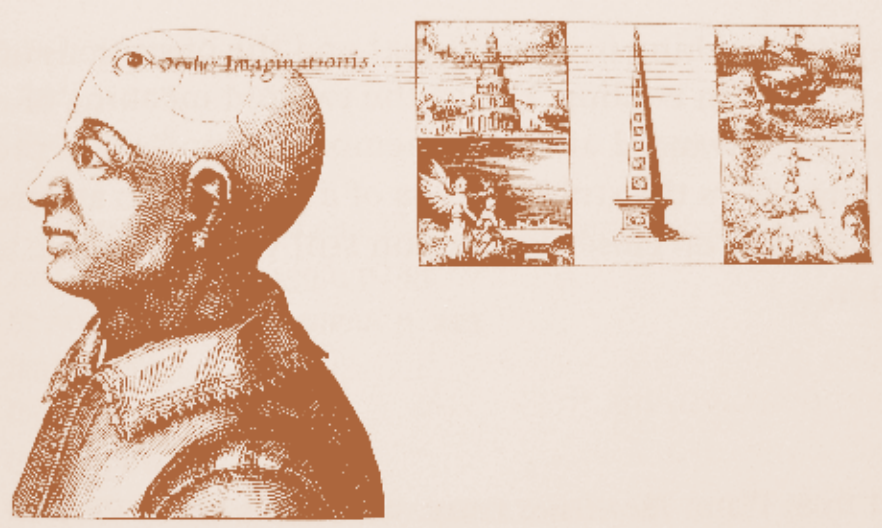
Daniel Stolzenberg (Postdoctoral Fellow, Stanford University, U.S.A.) worked on two projects: Athanasius Kircher and the discovery of Egyptian antiquity, and amulets as evidence in the historicization of magic by early modern European scholars. Kircher's attempts to decipher Egyptian hieroglyphics were utterly mistaken, but they ushered in the erudite orientalist tradition of the seventeenth century. Amulets had long been on interest in the context of magic, but around the turn of the seventeenth century a different kind of amulet literature emerged that was not primarily interested in how to use them, but instead treated them as evidence of ancient civilizations.

A "Gnostic" amulet. From the Magical Amulet Collection of the Taubman Medical Library

Udo Thiel

Udo Thiel (Visiting Scholar, Australian National University, Canberra) continued a book project on the notions of self-consciousness and personal identity in eighteenth-century German, French, and British philosophy. The book aims both to give an intellectual history of the subject and also to situate these developments in historical context, with special attention to the history of science and theology.

Koen Vermeir (Predoctoral Fellow, Katholieke Universiteit Leuven, Belgium) completed a dissertation on early modern medical and natural philosophical theories on the power of the imagination to influence not only mind but also body. His stay at the MPIWG was financed by a grant from the Fund of Scientific Research—Flanders.



Frontispiece of Robert Fludd's book on mnemonics that was part of his *Utriusque cosmi* (1617–1619). One can see a stylised depiction of the ventricles of the brain, corresponding to imagination, cogitation and memory. The 'eye of the imagination' in the front ventricle is depicted in its contemplation of mnemonic images.

Catherine Wilson (Visiting Scholar, University of British Columbia, Canada) investigated the revival of Epicurean materialism in seventeenth-century metaphysics, natural philosophy, and political and moral theory, as well as its contribution to the formation of an empiricist approach to the knowledge of nature and of experimental practice.

Ongoing Projects

Between the Natural and the Human Sciences

Current classifications of knowledge that divide the disciplines up depending on whether they study the natural or human realms do not do justice to either historical or contemporary interactions among the natural and human sciences. Department II has a longterm commitment to the investigation of these interactions, at the levels of shared scientific concepts, practices, and epistemological categories.

Between the Natural and the Human Sciences
Cooperations

"The Cerebral Subject. The Impact of the Neurosciences in Contemporary Society:" Collaboration between the MPIWG (coordinator: Fernando Vidal) and the Universidade do Estado do Rio de Janeiro/UERJ, Brazil (coordinator: Francisco Ortega), financed by the German Academic Exchange Service (DAAD).

"The History of the Human Sciences:" Collaboration between the MPIWG (coordinator: Lorraine Daston) and the University of Chicago, U.S.A. (coordinators: Robert J. Richards, Alison Winter), financed by both parties.

Between the Natural and the Human Sciences
Conferences

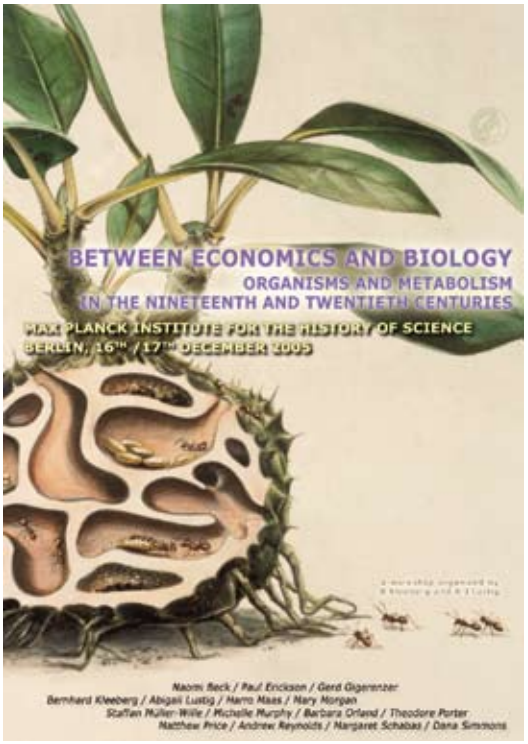
Facts, December 14, 2005. In collaboration with the London School of Economics, U.K.

ORGANIZERS *Bernhard Kleeberg* (MPIWG), *Mary Morgan* (London School of Economics, U.K.)

This one-day workshop brought together case studies drawn from the natural and human sciences as the basis for a discussion of the shared epistemological category of the fact.

Between Economics and Biology: Organisms and Metabolism in the Nineteenth and Twentieth Centuries, December 16–17, 2005.
ORGANIZERS *Bernhard Kleeberg* (MPIWG), *Abigail Lustig* (University of Texas at Austin, U.S.A.)

Since Aristotle's description of the *oikos*, ideas of human and natural economies have been linked. Metaphors, ways of understanding, standards of judgment, epistemic practices, and models have moved freely among moral philosophy, theology, the physico-mathematical and the physiological sciences, natural history, anthropology, political economy, and biology. This conference focused on a key area of exchange between economics and the biological sciences: concepts of the organism and its metabolism.



Between the Natural and the Human Sciences
Planned conferences

The Neurosciences and Contemporary Society, Rio de Janeiro, Brazil, August 2–4, 2006. Organized in the framework of the DAAD-supported project "The Cerebral Subject." Financed by MPIWG, the State University of Rio de Janeiro, the Brazilian CAPES and FAPERJ, and the Instituto Bennett of Rio de Janeiro, with additional support from ETH Zurich, Switzerland, and the Institute for the History of Medicine and Public Health of the University of Lausanne, Switzerland.
Website: <www.brainhood.net.>
ORGANIZERS *Francisco Ortega* (Universidade do Estado do Rio de Janeiro, Brazil), *Fernando Vidal* (MPIWG).

On Knowing in the Human Sciences, August 24–25, 2006. In collaboration with the "History of the Human Sciences" cooperation.
ORGANIZERS *Lorraine Daston* (MPIWG), *Robert J. Richards* (University of Chicago, U.S.A.), *Alison Winter* (University of Chicago, U.S.A.).

On the Responsibilities of the Human Sciences, October 20–21, 2006, University of Chicago. In collaboration with the "History of the Human Sciences" cooperation and the Franke Center for the Humanities, University of Chicago.
ORGANIZERS *Lorraine Daston* (MPIWG), *Robert J. Richards* (University of Chicago, U.S.A.), *Alison Winter* (University of Chicago, U.S.A.).

Between the Natural and the Human Sciences
Individual Projects

Bethania Assy (Visiting Scholar, Universidade do Estado do Rio de Janeiro, Brazil) studied how the sixteenth-century authority of natural human rights has been transformed in post-Holocaust legislation concerning "crimes against humanity." She focused especially on the impact of new biotechnologies on the notion of human rights.

Naomi Beck (Predoctoral Fellow, Université de Paris I, France) completed a dissertation on the reception and transformation of Herbert Spencer's evolutionary theories in France and Italy. Spencer's theories came to inspire diverse and even opposed social, economic, and political doctrines as the context changed.

Luciana Vieira Caliman

Luciana Vieira Caliman (Predoctoral Fellow, Universidade do Estado do Rio de Janeiro, Brazil), supported by a DAAD dissertation fellowship, researched a dissertation on the inattentive individual as an object of scientific inquiry in two historical periods, the second half of the nineteenth century and the last third of the twentieth century. The first part centers on the work of psychologists and philosophers; the second, on that of physicians and psychiatrists in defining and diagnosing new "attention deficit disorders."

Illustration from the famous German children's story "Zappel-Phillip". First published in 1844

Doris Kaufmann (Visiting Scholar, Universität Bremen, Germany) examined the significance of primitivism as a conceptual framework or figure of thought during the emergence of the interdisciplinary *Kulturwissenschaften* in Germany in the early twentieth century. Two questions made primitivism central: first, the problem of explaining the origins and processes of "other" modes of thought; and second, that of recognizing them by researchers steeped in European modes of thought and perception.

Maria Cristina Franco Ferraz (Visiting Scholar, Universidade do Estado do Rio de Janeiro, Brazil), supported by a DAAD fellowship, continued her project on the modernization of perception in the nineteenth century, with special attention to the influence of physiological optics, psychology, neurology, and philosophy.

Michel Ferrari (Visiting Scholar, University of Toronto, Canada) studied the history of psychology as understood as the "science of consciousness," from the mid-nineteenth century through the advent of computer models in the 1950s and the rise of the neurosciences in the 1990s.

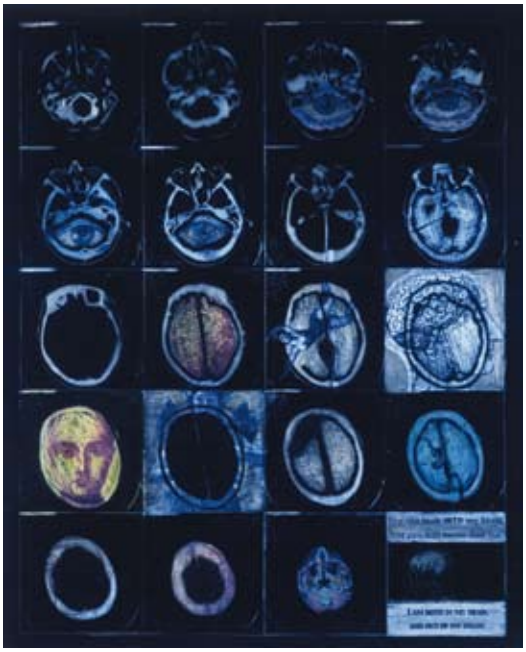
Luciana Kind (Visiting Scholar, Universidade do Estado do Rio de Janeiro, Brazil), supported by a DAAD fellowship, examined the impact of the definition of death as brain death in the 1960s on the somatic limits of self and personhood.

Abigail Lustig (Rathenau Postdoctoral Fellow, University of California at Berkeley, U.S.A.) investigated the history of debates over and explanations of altruism in evolutionary theory in the nineteenth and twentieth centuries. In the course of this period, the meaning of altruism has shifted from an ecstatic extension of empathy (Herbert Spencer) to the calculation of rational advantage through kin selection (W. D. Hamilton).

Amos Morris-Reich (Predoctoral Fellow, The Hebrew University of Jerusalem, Israel) supported by a dissertation fellowship from the Minerva Foundation, researched a dissertation on the race concept of Arthur Ruppin, first professor of Jewish sociology at the Hebrew University, within the context of both German Rassenkunde of the 1920s and '30s and American cultural anthropology of the 1920s.

Dorothea von Mücke (Visiting Scholar, Columbia University, U.S.A.) completed a project on Goethe's concept of metamorphosis in botany and zoology and his experimentation with various forms of authorship as he sought out an audience for his scientific work. She also formulated a new project on "Authorship and the Order of Nature. Models of Creativity and Originality in the Arts and Sciences in the Eighteenth Century."

Francisco Ortega (Visiting Scholar, Universidade do Estado do Rio de Janeiro, Brazil) supported by a DAAD fellowship, investigated the cerebral subject in popular culture in the nineteenth and twentieth centuries on hand from three cases: (1) the history of brain fitness and neurobics; (2) the relationship to spiritualism; and (3) portrayal in literature.



Susan Aldworth,
"Cogito Ergo Sum I" (2001)
(brain scan, gold leaf and collage
on paper, 350mm x 430mm)

Wolfgang Schivelbusch (Visiting Scholar) pursued a project on the concept of consumption in physiological and economic thought, 1770–1870, with a focus on the actual material interaction between the consuming subject and the consumed object. Both political economy and physiology understood the production of commodities to be one not only of transformation, but also of the destruction of the elements consumed.

Fernando Vidal

Fernando Vidal (Research Scholar) completed a book on the sciences of the soul in the sixteenth through the eighteenth centuries, variously expressed in logic, anthropology, physiology, and empirical psychology: *Les Sciences de l'âme, XVIe–XVIIIe siècles* (Paris: Honoré Champion, 2006; English translation forthcoming from the University of Chicago Press). Vidal continued work on his ongoing project on "Brainhood," the identification of the self with the brain. From science fiction to neurophilosophy and the medical practices of intensive care and organ transplantation, humans in the late twentieth century often came to be treated as not merely having a brain, but as being a brain. This is part of a much longer history, stretching back to Christian theological doctrines about the resurrection of the body, that elaborates the relationship between body and self, posing the question: What is the part of the body we need in order to be ourselves?

Gender Studies of Science

MPIWG ORGANIZERS *Christine von Oertzen, Annette Vogt*

The analytical category of gender comes close to being an anthropological universal, structuring almost all known cultures—their economies, politics, institutions, and thought systems. Historically, science has been no exception. Department II supports a number of studies on this topic on an ad hoc but long term basis.

Gender Studies of Science
Individual Projects

Delphine Gardey (Alexander von Humboldt Foundation Fellow, Centre National de Recherche Scientifique, France) researched a book on *The Female Body and Technoscience in the West during the Twentieth Century*, which compared French, British, American, German, and Dutch literature on the impact of contraception, new reproductive technologies, and new surgical techniques on women. She also continued work on a book about the intellectual tools and administrative technologies that made possible the rise of business technology and management: *Writing, Adding, Filing, and Computing Technologies from the End of the Eighteenth Century*.

Christine von Oertzen (Research Scholar) explored the forging of a transatlantic world of science and higher learning in the twentieth century and its lasting impact on Germany from a gendered perspective. By founding the International Federation of University Women (IFUW) in 1919, American and British University women funded the international exchange of female scholars and scientists, both teachers and students, a program with considerable impact on Central Europe. The comparative study historicizes concepts of academic identity and traces transnational cultural transfer in academic affairs.

Christine von Oertzen

International Convention of the IFUW 1932 in Edinburgh. Marching to the opening ceremonies, with the Mayor of Edinburgh and the President of the University of Edinburgh. Archive of the British Federation of University Women, London

Hannah Lotte Lund (Coordinator of the Research Network on the History of Scientific Objects) is completing a dissertation on the Jewish salon in Berlin circa 1800. Theoretically, in a time when women and Jews were excluded from almost any public career or forum, a salon provided an opportunity to participate in intellectual discourse of the time. In practice, Berlin Jewish salonières had access to rare books, participated in scientific experiments, and were inspired to write and publish on their own.

Annette Vogt

Annette Vogt (Research Scholar) completed a book on women scientists in Germany from 1899 to 1945, with special attention to developments after 1933, on hand from two long terms studies of women scientists, at the University of Berlin and at the Kaiser Wilhelm Institutes: *Vom Hintereingang zum Hauptportal? – Lise Meitner und ihre Kolleginnen an der Berliner Universität und in der Kaiser-Wilhelm-Gesellschaft* (Stuttgart: Franz Steiner Verlag, 2006).

Lise Meitner in the laboratory. Archive of the Max Planck Society, Berlin, 1931

Completed Projects

Since 2004, the results of several past departmental research projects have been published (or are currently in press). A brief summary of these follows.

Completed Project

The Values of Inconsistency

DURATION 2003–2005
MPIWG ORGANIZER *Lorraine Daston*
COOPERATION PARTNER Max Planck Institute for Collective Goods, Bonn, Germany

This collaboration between the MPIWG and the Max Planck Institute for Research on Collective Goods in Bonn, funded by the Max Planck Society's special fund to promote interdisciplinary initiatives, assembled a group of jurists, social scientists, philosophers, and historians to discuss the inevitability and perhaps desirability of various forms of inconsistency—including incoherence, contradiction, unpredictability, incompatibility, dissonance, irrationality, *akrasia*, and unacceptable compromise—in law, science, and everyday life. The results of these discussions, held at conferences in 2003 and 2004, were collected in Lorraine Daston and Christoph Engel, eds., *The Values of Inconsistency* (Baden-Baden: Nomos Verlag, 2006).

Completed Project

Natural Law

DURATION 1999–2005
MPIWG ORGANIZERS *Lorraine Daston, Sophie Roux, Friedrich Steinle*
COOPERATION PARTNERS Max Planck Institute for European Legal History, Frankfurt am Main, Germany, Universität Bern, Switzerland

Early modern Europe witnessed the efflorescence of a discourse of natural laws in both jurisprudence and natural philosophy. This project, the result of a collaboration between the MPIWG and the Max Planck Institute for European Legal History in Frankfurt a. M., brought together a group of historians of early modern law, science, philosophy, and theology to explore connections between the rise of natural law in these various disciplines. Three authors' workshops were held to present, discuss, and revise chapters of a collective volume: Lorraine Daston and Michael Stolleis, eds., *Natural Laws and Laws of Nature in Early Modern Europe* (Aldershot: Ashgate, in press).

Completed Project

The Moral Authority of Nature

DURATION 1999–2001

MPIWG ORGANIZERS *Lorraine Daston, Fernando Vidal*

The final publication of this project appeared, the results of a workshop on anthropomorphism held at the MPIWG in 2001:

Lorraine Daston and Gregg Mitman, eds., *Thinking with Animals: New Perspectives on Anthropomorphism* (New York: Columbia University Press, 2005).

Table of Contents

Completed Project

Common Languages of Art and Science

DURATION 2001–2003
MPIWG ORGANIZERS *Lorraine Daston, Mechthild Fend, Anke te Heesen*
COOPERATION PARTNER Harvard University, U.S.A.

→ "The Experimentalization of Life: Configurations between Science, Art, and Technology" p. 92

Common Languages of Art and Science
Working Group

The working group on Things that Talk, consisting of historians of art and science, met three times in the course of the project to plan, write, and revise a collective volume on how scholarship about things can combine accounts of matter and meaning:

Lorraine Daston, ed., *Things that Talk: Object Lessons from Art and Science* (New York: Zone Books, 2004).

Table of Contents

Common Languages of Art and Science
Individual Projects

Zeynep Çelik

Zeynep Çelik (Predoctoral Fellow, CASVA Fellowship, Massachusetts Institute of Technology, U.S.A.) "Kinaesthetic Impulses: Space, Performance, and the Body in German Architecture, 1870–1914."

Exterior view of Elvira Photography Studio. August Endell, Munich, 1898

Mechthild Fend

Mechthild Fend (Research Scholar) examined the human skin as both a representational problem within the visual arts and as a scientific object in late 18th- and 19th-century France. The latest result of her research is the completion of a book manuscript on the issue of fleshtones in art. It is a collected volume coedited with Daniela Bohde, entiteled *Weder Haut noch Fleisch. Das Inkarnat in der Kunstgeschichte*, due for publication at Deutscher Kunstverlag Berlin in fall 2006.

Thomas Odell Haakenson (Fulbright Predoctoral Fellow, University of Minnesota, U.S.A.) "The Uncultured Eye: Vision, Culture, and the Modern Grotesque."

Kristen Haring (Postdoctoral Fellow, Harvard University, U.S.A.) "Technical Hobbies—Technical Culture."

Anke te Heesen (Research Scholar) completed her book on newspaper clippings in art and science: *Der Zeitungsausschnitt. Papierobjekt der Moderne* (Frankfurt am Main: Fischer 2006). In her comparative case studies on the clipping collections of the physicist Ernst Gehrcke from Berlin, the Hamburgian Archive of World Trade, and the artist Kurt Schwitters in Hannover, she traces the paths of the paper-object through different, but contemporaneous areas.

Anke te Heesen

Kathrin Müller (Predoctoral Fellow, Universität Hamburg, Germany; Gerda-Henkel and Evangelisches Studienwerk Dissertation Fellowships) "Visual Appropriation of the World: Astronomical and Cosmological Diagrams in Latin Manuscripts of the Eleventh to Early Fourteenth Centuries."

Kathrin Müller

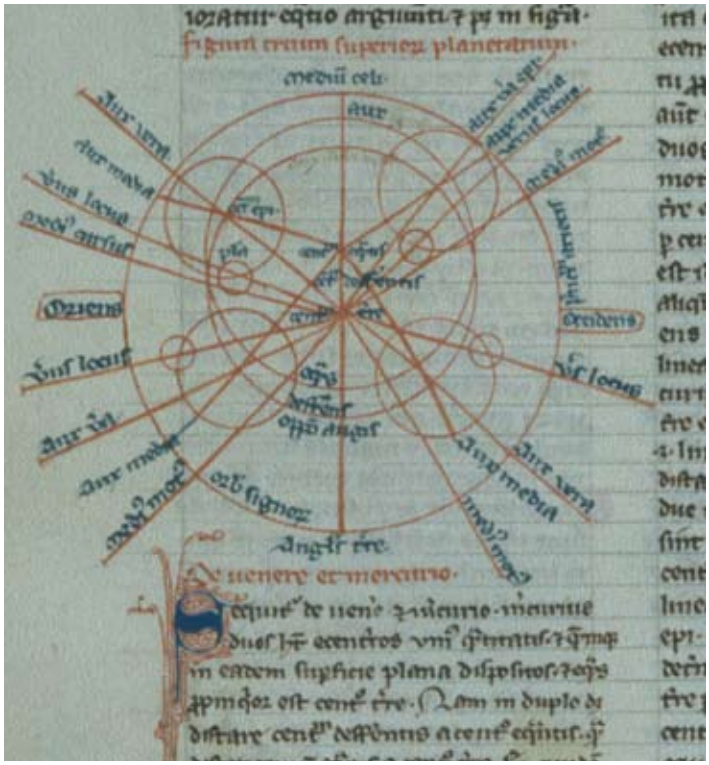


Figura trium superiorum planetarum: Diagram showing the movement of the planets Saturn, Jupiter and Mars. *Theorica planetarum*. Anonymous, Oxford, Bodleian Library, MS Laud Misc. 644 (1487), fol. 117v. Bayeux, 1268–74

Anna Somfai (Visiting Scholar, Central European University, Hungary) "The Nature, Role, and Transmission of Diagrams and Diagrammatic Images in Early Medieval Manuscripts of Philosophical, Scientific, and Encyclopedic Texts."

Ashley West (Predoctoral Fellow, University of Pennsylvania, U.S.A.; David E. Finley Fellowship, Center for Advanced Study in the Visual Arts, Washington, DC) "Visualizing Knowledge: Prints and Paintings by Hans Burgkmair the Elder (1453-1531)."

M. Norton Wise (Visiting Scholar, University of California at Los Angeles, U.S.A.) "Bourgeois Berlin and Laboratory Science."

Upcoming Events for 2006

Islamic Scientific Manuscript Initiative (ISMI), first meeting of the Advisory Board, September 18–19, 2006.
ORGANIZERS *Lorraine Daston* (MPIWG), *Jamil Ragep* (McGill University, Canada), *Sally Ragep* (McGill University, Canada)

The Islamic Scientific Manuscripts Initiative (ISMI) is an international collaborative project that makes available an online resource on the exact sciences in the premodern Islamic world. Providing information on the social, religious, intellectual, and political contexts in which this material was produced as well as its influence on other cultures, it is accessible without charge to researchers in the field and to the public worldwide. The database includes works of 1700 scientists (astronomers, mathematicians, physicists, geographers) who span the entire Islamic world, from the 8th to the 19th centuries. The staff of researchers, technicians, and consultants works closely with an international advisory board and institutional affiliates. Institutional support is provided by the Max Planck Institute for the History of Science, Berlin, and the Institute of Islamic Studies, McGill University, Montreal.

Advisory Board Members

- *S. M. Razaullah Ansari* (Muzammil Manzil Compund, Aligarh, India)
- *François Charette* (Universität Frankfurt am Main, Germany)
- *Benno van Dalen* (Universität Frankfurt am Main, Germany)
- *Ahmed Djebbar* (Université de l'Ille 1, France)
- *Ihsan Fazlioglu* (University of Istanbul, Turkey)
- *Elaheh Kheirandish* (Harvard University, U.S.A.)
- *David A. King* (Universität Frankfurt am Main, Germany)
- *Tzvi Y. Langermann* (Bar Ilan University, Israel)
- *Ulrich Rebstock* (Universität Freiburg, Germany)
- *Julio M. Samsó* (Universitat de Barcelona, Spain)

Affiliated Institutions

- Aga Khan University, London, U.K.
- Archimedes Project, Harvard University, U.S.A.
- Universitat de Barcelona, Spain
- Encyclopaedia Islamica Foundation, History of Science Department, Tehran, Iran
- Institute for the History of Arabic Science, Aleppo University, Syria
- Institute for the History of Science and Technology, Moscow, Russia
- The Institute of Ismali Studies, London, U.K.
- University Library Leiden, The Netherlands
- Warburg Institute, London, U.K.
- The Written Heritage Research Center, Tehran, Iran

Before Copernicus, first meeting of working group, December 13–15, 2006

→ "Knowledge and Belief" p. 61

ORGANIZERS *Rivka Feldhay* (Tel Aviv University, Israel), *Jamil Ragep* (McGill University, Canada)

The working group will explore the background to and context of Copernicus' *Commentariolus*, including not only astronomy, but also eschatology, theology, calendar reform, court politics, early humanism, natural philosophy, and art. A collective publication is planned.

Members

- *Nancy Bisaha* (Vassar College, Poughkeepsie U.S.A.)
- *Christopher S. Celenza* (Johns Hopkins University, Baltimore, U.S.A.)
- *Raz Chen-Morris* (Bar Ilan University, Israel)
- *Ihsan Fazlioglu* (Istanbul University, Turkey)
- *Tzvi Langermann* (Bar Ilan University, Israel)
- *Maria Mavroudi* (University of California at Berkeley, U.S.A.)
- *Robert Morrison* (Whitman College, Washington, U.S.A.)
- *Michael Shank* (University of Wisconsin, Madison, U.S.A.)
- *Edith D. Sylla* (North Carolina State University, Raleigh, U.S.A.)

Man Ray, L'Enigme d'Isidore Ducasse

Department III

Experimental Systems and Spaces of Knowledge

Director: *Hans-Jörg Rheinberger*

The core of the research activities of Department III is devoted to 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 the most important factor of social innovation and 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 counts as reliable, although they are essentially dealing with objects that still lie in the realm of the unknown, and although, in exploring this realm, they constantly have to be willing to discard knowledge that was believed to be certain?

In one way or another, all projects of Department III are exploring the dynamics of scientific change. Many 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 and psychology; from an anatomy based on dissection around 1800 to an instrument-mediated medicine and *in vitro* biology in the twentieth century. Particularly within the last 150 years, the realm of the life sciences has experienced a tremendous expansion. Particular areas of expertise, of model organisms, instruments, and experimental arrangements have developed into disciplines with remarkable stability, physiology being a good example of this. But disciplines have also dissolved again, such as phrenology, and given way to new and different fields of research. Experimental objects, instruments, methods, concepts, and specialists have changed places and have been reconfigured in ever changing constellations, resulting in unprecedented developments.

In order to explore these dynamics in depth, the research projects of the Department are organized around topical domains from a long-term perspective and embedded in a multidisciplinary horizon. The individual projects of the research scholars and post-doctoral fellows usually take two to five years. New projects are selected in such a way that there is a certain amount of overlap with existing and ongoing research activities in one of the domains. This allows enough scope for the development of

individual research agendas, and at the same time encourages the emergence of new collaborative projects extending over disciplinary and epochal boundaries. A considerable number of projects of the Department are joined together in such larger collaborations developed over the past years (see below), whereas others are pursued individually. The workshops of the Department are related to its project activities. All members of the Department meet regularly for a biweekly colloquium, where they present their ongoing work to the whole group. The Department also works on the establishment 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 from the history of the life sciences, but also to constructing an electronic research and publication environment. Since its establishment in 1997, three topical domains have been instrumental in shaping the work of the Department. They shall be described briefly, before reporting on the work in the period between 2004 and 2005.

History and Epistemology of Experimentation

→ "Historia experimentalis" p. 136
→ "Experimental History of Science" p. 143

Philosophers and historians of science agree that since the early modern period, experiments have 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 transpires that there is no such thing as "the" experimental method. In contrast, different forms and styles of experimentation must be distinguished. They relate to particular phases of scientific work, and 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. In this respect, we can talk about a history of experimental systems. Often enough, phenomena that initially were seen as artifacts or disturbances move into the center of attention, and methods that were seen as unproblematic data collection devices move 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

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 by themselves; they become scientifically meaningful only inasmuch as they come to embody general phenomena such as organic 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. As a rule, these objects are embedded in real and symbolic spaces within which they are manipulated, and indeed which they also shape. Natural cabinets, laboratories, the "field" of the zoologist or the anthro-

pologist, but also "virtual" environments such as the paper spaces of the laboratory protocol or computer simulations are instances of such spaces that require new forms of attention, and whose emergences and configurations we investigate in historical detail.

→ "History of Scientific Observation" p. 49

Formation of Concepts and Uses of Theory

Processes of scientific innovation also 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 that concepts and theories play in scientific practice. We are interested in the organizing function of concepts in devising and performing experiments; in their role with respect to the creation of research domains and scientific disciplines; in the relations between verbal and pictorial argumentation in the historical development of the life sciences; and in the movement of metaphors between scientific and extra-scientific texts.

→ "Practical Experience and Conceptual Structures" p. 21

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; their further development depends on achievements that may stem from other disciplines, result in the dissemination and solidification of technologies, and in this form, impinge on neighboring disciplines. There appears to be no universally and permanently valid "logic" of research that would allow 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 at present may deploy destructive effects in the future. Science, as a thoroughly human undertaking, has to be analyzed in all its historical ambivalence.

Project

The Experimentalization of Life. Configurations Between Science, Art, and Technology

RESEARCH SCHOLARS *Sven Dierig, Julia Kursell, Henning Schmidgen*
PREDOCTORAL FELLOWS *Björn Brüsch, Philipp Felsch, Katrin Solhdju*
VISITING SCHOLARS *Klaus Staubermann, Rand Evans, Elfrieda and Erwin Hiebert*
COLLABORATIONS Helmholtz-Zentrum für Kulturtechnik at the Humboldt University Berlin, Media Department at the Bauhaus University of Weimar, Program in History of Science of Stanford University, Zentrum für Literaturforschung Berlin
FUNDING VolkswagenStiftung, MPIWG

This project started in the fall of 2000 and was supported by the VolkswagenStiftung for five years until the fall of 2005. Now it has been established as one of the long-term projects of the Department.

Experimentation is not restricted to science. It has often been noted that the 19th century was a century of laboratory science. Less attention, however, has been paid to the fact that in the same period literary writers, artists, and engineers also claimed to perform experiments. Thus, Emile Zola set out to write experimental novels,

Physiological Laboratory,
in: Ter Herinnering van de veertig jarige Amtsvervulling van D. B. Kagenaar Sr., 1860 1--Mei--1900 [photographic album]. Utrecht (University Museum Utrecht, Archive-Box 1151)

Giacomo Balla called his studio a "laboratory," and the Russian avant-garde strove to perform experiments with life in the Soviet Union. One of the main goals of this project is to take such claims seriously and to write a trans-disciplinary comparative history of experimentation.

The main focus is on the history of the experimental life sciences, mainly 19th century physiology. This research field had an important impact on other, until then non-experimental domains. Psychology, aesthetics, and linguistics, for example, were all adopting the model of physiology when turning experimental in the 1870s.
More specifically, the project investigates a variety of configurations betweens science, art and technology. For example, it covers the interactions between frogs and machines as they were produced in physiological laboratories around 1840; the dialogue between music and experimental acoustics as it started in the 1860s; time experiments from Helmholtz to Proust, and the transfer of graphical instruments from the laboratory to the Italian Alps around 1890. It also covers drug experiments in medicine and literature, and the invasion of gardening practices by experiment.

In the context of this project, the term "experimentalization" addresses the peculiarities of scientific developments as well as broader cultural trends. There are obvious parallels, but also important differences between the emergence and extension of the laboratory-based life sciences on the one hand and more general processes such as the industrialization and rationalization of society or the mechanization of culture on the other. In many ways, the histories of laboratories and experiments resemble the histories of factories and machines.

One of the main results of this project has been that experimentalization, with its peculiarities, cannot be understood as a one-dimensional process. In other words, the laboratory revolution did not take place in the way earlier studies have taught us. With respect to experimental set-ups and instruments, there are striking continuities between 1840 and 1890. What did change were *styles* of experimentation, i. e. the way in which instruments and organisms were connected, the spatial arrangement of experimental components, the time regimes that were implied—in short: the significance or values attached to performing experiments in the lab. As a consequence, experimentalization is not to be seen as a homogeneous process, but rather as a sort of patchwork of local activities, loosely connected yet highly productive.

Experimentalization of Life

The Laboratory in the City: Urbanization, Industrialization, and the Place of Experiment in 19th Century Physiology

Sven Dierig (Research Scholar)

Sven Dierig

Laboratories, along with the researchers, organisms, instruments, and experiments associated with these places of investigation, are not isolated from the world beyond their physical and institutional boundaries. Like universities, museums, hospitals, botanical gardens, and other institutions of scientific research and education, laboratories are typically located in cities—and both are subject to change. Taking the example of Berlin and the institutionalization of experimental physiology by Emil du Bois-Reymond, the project has been dedicated to connecting aspects of modernity that usually have been researched separately:

1. The laboratory as a material and cultural workplace where experimental phenomena and scientific knowledge are generated, and
2. the dynamic and far-reaching transformation of the urban space during the nineteenth-century industrial revolution. In the light of an "urban history of physiology" which analyzes the laboratory revolution in physiology in the context of the urban revolution, the fundamental aim of the project is to understand how cities and laboratories "cooperate" in the production of scientific novelty.

Membership card of the Physikalische Gesellschaft zu Berlin

The study followed three major themes that illustrate how urban culture and everyday life, urban organization of labor and commerce, and urban power sources and technology extended through the laboratory walls and became part of the social and material culture of experimental investigation in the Berlin laboratories for physiology.

1 Organisms: In the nineteenth century, physiologists carried out experiments on objects such as frogs, cats, rabbits or dogs. Research fields, experimental set-ups, and instruments within physiology crystallized around such "model organisms."
2 Instruments: This focus of the project is on the role of technology in the making of scientific novelty during the time when Berlin became a technological metropolis.
3 Laboratories: The late 19th century physiology laboratory is highlighted as a specific place of work designated for the factory-like production of new experimental phenomena. This project is now completed.

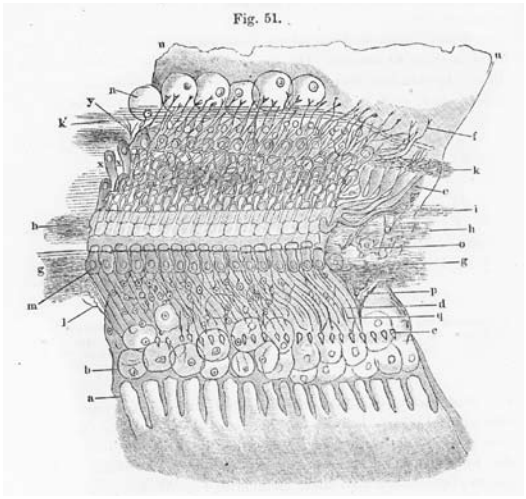
Experimentalization of Life

Ear and Instrument—Hermann v. Helmholtz's *On the Sensations of Tone as a Physiological Basis for the Theory of Music*

Julia Kursell (Research Scholar)

Julia Kursell

The project investigates the relation of psycho-physiological research and musicological theory. It considers music as an experimental set-up in its own right, and it traces the changes in the aesthetics of music brought forth by physiological research. The starting point is Hermann von Helmholtz's *On the Sensations of Tone as a Physiological Basis for the Theory of Music*, first published in 1863. In this work, Helmholtz develops a theory of hearing, according to which the ear functions as a measuring instrument, analyzing complex waveforms and resolving them into their sinusoidal components. Instrument makers, just like musicians and composers, are guided in their work by this activity of the ear, and therefore a tacit, empirical knowledge is enclosed in their products. Ear and instrument are connected by more than just a metaphor: Helmholtz perceives the piano to be a reconstruction of the ear, and likewise, the function of the ear is modeled on the piano. Furthermore, Helmholtz reproduces the rules of music theory and the history of music by means of experimentation, just as the teaching of orchestration involves extensive self-description of music as an experiment. Step by step, the European tradition of music has, as it were, explored its own physiological conditions, and so the distinctions between major and minor, or consonance and dissonance, corroborate the physiological theory of hearing.



The Organ of Corti as shown in: On the sensations of Tone as a Physiolgical Basis for the Theory of Music by Hermann v. Helmholtz.

Yet this circularity of technology, physiology and aesthetics, of musical instruments, experimental set-ups, and the theory of music had far-reaching effects. The experimental set-ups used by Helmholtz produced new sounds, i. e. sounds not present in 19th century music, and the very aesthetics of music that was to prove the physiological theory of hearing eventually collapsed under its scientific explanation. 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, is known to have abandoned this distinction: Thus the book *On the Sensations of Tone* points toward aesthetic experiments, the outcome of which is left open.

Experimentalization of Life

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

Henning Schmidgen (Research Scholar)

Henning Schmidgen

This project deals with the emergence and development of the physiological and psychological short-time experiments. These experiments, it is argued, have key importance for the history of the neurosciences, brain research, psychology and the cognitive sciences. Since the 1860s, physiologists and psychologists have conducted short-time measurements in order to determine the temporal relations given in the human brain and nervous system. The measurements generated a wide range of hypotheses on the anatomical structures and physiological functions involved in reaction processes and provoked far-reaching arguments about the nature of human consciousness, thought, and voluntary action.

The project approaches the historical material by way of a generalized notion of "machines" In this perspective, experiments are conceived of as complex, distributed machines that integrate within local settings a multiplicity of heterogeneous components, i. e. scientists, model organisms, instruments, concepts etc. In addition, experiments are seen as embedded in larger socio-technological assemblages (e. g. laboratories, clinics, factories) that have an impact on their application and distribution. At the same time, they can be reduced to core elements that function together despite their fundamental heterogeneity, e. g. frog muscles and telegraphy keys, tuning forks and organic membranes. This approach not only allows one to contextualize experiments with respect to space, but also with regard to time and, more generally, with respect to their intrinsic dynamics. It is argued that reaction time experiments relied on combinations of interrupted flows: flows of organic and inorganic movements, flows of energy, of writing, speech etc. As a result, the history of physiological and psychological time experiments turns into a history of material continuities between, and variations of, machines producing precise measurements and provoking new theories and concepts within different institutional settings.

Experimentalization of Life

Experimentalization of Gardening in 19th Century Germany: Peter Joseph Lenné and the "Gärtner-Lehranstalt" at Wildpark/Potsdam

Björn Brüsch (Predoctoral Fellow)

Björn Brüsch

Much of the promotion of Prussian "Landeskultur" in the early 19th century was closely connected to the use of land as gardens—both on a rhetorical and a practical level. This movement led to the establishment of an institution specifically aimed at providing gardeners with a comprehensive education. Gardeners were no longer meant to be humble land-workers but rather experts of cultivation of all the resources that nature provided. The new school was molded on the example of the Parisian Jardin des Plantes with its head gardener and professor for plant cultivation, André Thouin. Like the botanical garden in Paris that was a center of expert knowledge for the Republic, the Gardeners' Institute in Berlin was to function as a prominent center of Prussian "Landeskultur."

Peter Joseph Lenné became the first director of the Royal Gardeners Institute founded in August 1823. Teachers were recruited from the Society for the Advancement of Horticulture in the Royal Prussian States and the Botanical Garden in Schöneberg / Berlin. Besides practical matters, the garden artists were acquainted with basic knowledge in botany, physics, chemistry, and physiology. Using archival material, the project follows in detail how Lenné composed a draft of the organization of the school and how he set up his program of scientific gardening. In sum, the institute provided a space in which the garden became a "laboratory of plant sciences," as Alexander Braun put it in 1852. The project aims to situate this development in the broader context of 19th century efforts to render agriculture scientific.

Ch. W. P. Beuth flying on a Pegasus (1837)—"Ich schwebe über einer von mir gegründeten Fabrikstadt auf dem Pegasus und mache Seifenblasen. (Bemerkung Beuths)". Karl Friedrich Schinkel, Fig. in Karl Friedrich Schinkel 1781–1841 (1980), p. 314, quotation from Wolzogen (1862): Aus Schinkels Nachlaß. Reisetagebücher, Briefe und Aphorismen. Zweiter Band. Berlin: Kgl. Geh. Oberhofdruckerei, p. 337, picture lost since 1945

Experimentalization of Life

Laboratory Landscapes: The Alps as a Medium of Physiology Circa 1900

Philipp Felsch (Predoctoral Fellow)

The project focuses on Alpine physiology around 1900. The main argument is that mountains were an "intensive place" of modernity. Experimental physiologists left the closed space of their laboratories and developed a thermodynamic, almost Nietzschean image of man, ironically under the eyes of an increasing vacationing middle-class. Like a magnifying glass, the history of Alpine physiology exposes two essential modes of speechlessness in the 19th century: the deep "subjectivity" of landscape experience on the one hand, and the austere "objectivity" of scientific experimentation on the other.

The aesthetic discovery of the Alps in the eighteenth century had physiological traits from the very beginning. When Johann Joachim Winckelmann, the German father of classicism, crossed the St. Gotthard Pass in 1760, he shut the windows of his coach to avoid the ugly sight of rocks and snow. 50 years later, Percy Bysshe Shelley wrote his famous poem about Mont Blanc with his eyes on the mountain. Shelley still considered mountains terrible, and would under no circumstances have climbed them. It was Horace Bénédict de Saussure, the Genevan professor of natural history, who transcended the romantic mountain genre. When his dream of climbing the Mont Blanc was finally realized, he could not help but stamp around the top of the mountain in anger: Far above the tree line, the sublime shudder had turned into a physical calamity.

Experimental Set-Up. Photograph taken in Angelo Mosso's Laboratory (from the Angelo Mosso Papers)

In 1861, Auguste Rosalie Bisson and his 25 porters managed to expose collodion plates on the summit of Mont Blanc. Both the public and the critics were enthused about the feat. Throughout the second half of the nineteenth century, mountain photography was surrounded by a discourse on the heroic conditions of its production. Better than any words could, the new mechanical images captured what it physically meant to climb up the high Alps. But rather than symbolizing sublimity, they indicated fatigue. By using the graphic method, Jean Chauveau could render the moun-

taineers' troubles observable: For the first time, he translated mal de montagne, vertigo, and fatigue into mechanical tracings. In Italy, Angelo Mosso extended Alpine physiology and even managed to invest it with national prestige. The project analyzes how the stammering language of poetry was replaced by the silent language of curves, and how the romantic theatre was turned into a laboratory landscape for experiments on modern fatigue. This project has now been completed.

Experimentalization of Life

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

Katrin Solhdju (Predoctoral Fellow)

Katrin Solhdju

The aim of this project is to investigate how different practices and techniques of approaching the self changed and shaped concepts of subjectivity and selfhood and vice versa. It focuses on a specific kind of experimentation on vital processes in which the experimenter poses as the subject and the object at the same time.

Self-experimentation as a practice has always existed in various contexts, but only at the end of the 18th century was it sanctioned as a necessary step in the process of developing drugs in pharmaceutics. Mainly due to ethical reasons, the researcher himself was to "go first" thereby taking primary risk. In the context of her dissertation project, Katrin Solhdju is investigating the role self-experimentation played in various scientific and non-scientific contexts between the late 18th and the early 20th centuries. Her claim is that around the end of the 18th century, the self-experiment gained an epistemological status that transcended the realm of risk management and ethical concerns. The assumption is that self-experimentation was epistemologically always tied to experimenting *with* the self, and methodologically to introspection. Therefore, the reconstruction of self-experimental contexts not only raises theoretical questions concerning the operating modes and the status of experiments, but is also aimed at contributing to a history of subjectivity. The case studies include the French psychiatrist Moreau de Tours, the British statistician Francis Galton, the American amateur philosopher Benjamin Paul Blood and psychologist William James.

Experimentalization of Life

The Virtual Laboratory

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

The Virtual Laboratory is a digitalization project devoted to the history of the experimentalization of life with a focus on the interaction between life sciences, arts and technology. The project is developed in close cooperation with the IT Group and the Digitalization Group of the Institute.

Online since 2002, the Virtual Laboratory has become a unique research tool for the history of 19th century physiology, understood in a broad sense. Currently, it has some 9,000 individual page accesses per week. The Virtual Laboratory offers more than 25,000 bibliographical references, partly covering journal articles and also consisting of complete bibliographies established for some twenty eminent physiologists and psychologists: Du Bois-Reymond, Helmholtz, Bernard, Marey, Donders, etc. The Virtual Laboratory also includes all 19th century references from Karl Rothschuh's comprehensive bibliography concerning the history of physiology, in a completed and updated form. As a special feature, the laboratory offers access to all book titles available in two private 19th century libraries: Those of Johannes Müller and Wilhelm Wundt, in total some 5,000 items. This collection will soon be supplemented by Franciscus Donders's library. The Virtual Laboratory displays a total of some 3,000 scanned items consisting of approximately 2,000 journal articles, 250 book chapters, 120 monographs and textbooks, and some 180 trade catalogues, all to be downloaded and printed out easily. In total, there are some 120,000 pages available.

The Virtual Laboratory is not just a digital library, however. It is also a powerful research tool. Besides the bibliographical references, there are more than 20,000 referenced images that are searchable by caption, author and image type. To date, this image database has focused primarily on instruments. Search results show image captions and direct the user to the book, article or catalogue from which the image is taken. In addition, the Virtual Laboratory contains a so-called "trend-scout," a tool allowing statistical analyses of bibliographical references. Another user tool will be implemented in the near future. The Virtual Laboratory will allow users to create their own workbenches where subscribers can build, manage and share subsets of annotated sets of objects, such as literary sources, library searches, biographies, sites, etc.

Finally, the Virtual Laboratory offers ample space for scholarly publications. The project publishes short articles on the history of 19th and early 20th century experimental physiology and psychology. These articles are linked to the holdings in the digital library and to the various other sections of the Virtual Laboratory: short biographies, laboratory descriptions, instruments, etc. Scholars from outside the institute working on related topics and sources have also started to publish here.

Experimentalization of Life

Projects of the Visiting Scholars

- *Rand Evans* (East Carolina University, Greenville, U.S.A.): "Brass Instruments—A History of Scientific Instruments in Experimental Psychology, 1830–1930"
- *Elfrieda and Erwin Hiebert* (Boston): "Pianos, Pianists and Composers in the Changing Landscape of Late 19th Century Acoustics"
- *Klaus Staubermann* (Universiteitsmuseum Utrecht, The Netherlands): "Appropriating Experimentation in Museum Databases"

Experimentalization of Life

Activities Related to the Project

- Workshops and Exhibitions:
  "Zwischenräume: Seriality; Vitalism/Mortalism; Figures of Isolation; Infection and Immunity." Four Workshops organized together with the Helmholtz-Zentrum für Kulturtechnik and the Zentrum für Literaturforschung, Berlin, February 6 and June 25, 2004, January 28 and July 15, 2005.
  "Kultur im Experiment." Presentation of a book comprising the papers of the Opening Conference of the project, in conjunction with Kadmos Verlag, Berlin, June 9, 2004.
  "Labor und Seminar. Berliner Kulturräume der Wissenschaften im 19. Jahrhundert." Workshop organized together with the Institute for the History of Medicine (Charité), Berlin, March 10–12, 2005.
  "The Shape of Experiment." International Conference, Berlin, June 2–5, 2005.
  "Apoll im Labor." Exhibition organized by Sven Dierig in cooperation with the Museum for the History of Medicine at the Charité, Berlin, May to October 2005.
- Completed Dissertations:
  Julia Voss: "Darwins Bilder. Ansichten der Evolutionstheorie 1837–1874" (2005).
  Margarete Vöhringer: "Avantgarde und Psychotechnik. Wissenschaft, Kunst und Technik der Wahrnehmungsexperimente im postrevolutionären Russland" (2005).
- Books:
  Henning Schmidgen, Peter Geimer, and Sven Dierig, eds. *Kultur im Experiment*. Berlin: Kulturverlag Kadmos, 2004.

Henning Schmidgen, ed. *Lebendige Zeit*. Berlin: Kulturverlag Kadmos, Berlin 2005.
Sven Dierig. *Wissenschaft in der Maschinenstadt. Emil Du Bois-Reymond und seine Laboratorien in Berlin.* Göttingen: Wallstein Verlag, 2006.
Peter Geimer, ed. *UnTot.* Verhältnisse von Leben und Leblosigkeit. Berlin: Kulturverlag Kadmos, (in press).

Project

A Cultural History of Heredity

RESEARCH SCHOLARS *Staffan Müller-Wille, Hans-Jörg Rheinberger, Christina Brandt*
POSTDOCTORAL FELLOWS *Jennifer Marie, Bernd Gausemeier*
VISITING SCHOLARS *Soraya de Chadarevian, Edna Suárez-Díaz*
SHORT TERM QUEST RESEARCHERS *Jonathan Harwood, Manfred Laubichler*
COLLABORATIONS MPIWG, Dept. I *(Wolfgang Lefèvre and Peter McLaughlin)*, School of Life Sciences at Arizona State University in Tempe, ESRC Centre for Genomics in Society at the University of Exeter
FUNDING DFG, Government of Liechtenstein, British Council, German Academic Exchange Service (DAAD), British Academy, and MPIWG

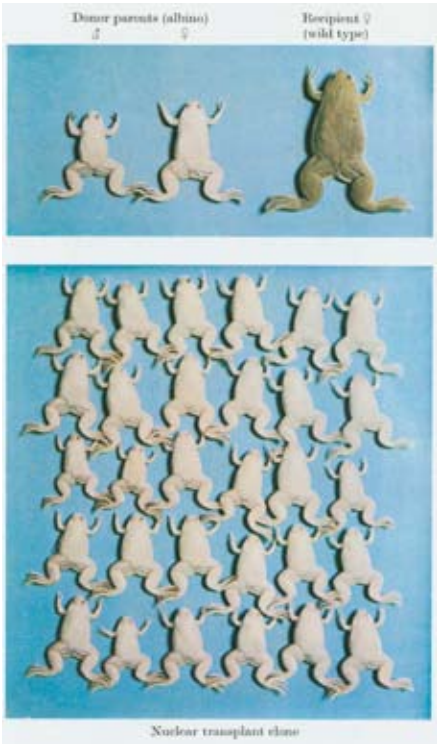
This project centers on the history of the scientific and technological practices in which the knowledge of biological "heredity" became materially entrenched and the cultural contexts in which it unfolded its effects. Knowledge of "heredity" is taken here as encompassing much more than the scientific discipline of "genetics," namely a knowledge regime in which a naturalistic conception of inheritance has slowly been 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, as it aims to draw together expertise, besides history of science, from 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.

These epochs cut across the received turning points in the history of biology "around 1800" and "around 1900." We concentrate on periods characterized by certain developments in the field itself. The following phases are distinguished: the first, extending from the late seventeenth century to the 1780s, in which "heredity" came into exis-

tence in several separate but confined fields, such as horticulture or pathology; the second, lasting to the middle of the nineteenth century, in which "heredity" became central to the life sciences; the third, covering the period from 1870 to the 1930s, in which heredity became experimental and mathematical; the fourth, from the 1930s to the 1970s in which heredity went "molecular;" and, finally, from the 1970s to the present, the fifth, characterized by the technological application and commodification of molecular hereditary knowledge.

The first workshop, focusing on the seventeenth and eighteenth centuries, took place in May 2001. A second workshop on the late eighteenth and early nineteenth century was held in January 2003. The third workshop on the second part of the nineteenth century took place in January 2005. The fourth workshop is in the planning stage and will be held in December 2006 at the University of Exeter. The results of the workshops will be published in two essay collections. A first volume is currently being published by MIT Press.



Cloned frogs, in: John Gurdon: The Cronian Lecture, 1976. Egg cytoplasm and gene control in development, in: Proceedings of the Royal Society of London, Series B, Vol. 198 (1977), p. 211–247, 218

Cultural History of Heredity

Landscapes of Experimentation: Research on Heredity in Early Twentieth Century Germany

Hans-Jörg Rheinberger (MPIWG, Director)

Hans-Jörg Rheinberger's current research focuses on a number of case studies designed to map the development of experimental genetics in Germany from the end of the 19th to the middle of the 20th century. The general aim of the project is to look at the material characteristics of different experimental systems and related strategies of experimentation, and to understand the impact they had on the historical shape and development of heredity research in the early 20th century. These experimental systems and strategies of experimentation were rooted in, and therefore carried the stamp of, a number of different disciplinary backgrounds.

The project is aimed at characterizing what may be called a "landscape of experimentation." Landscapes of experimentation are to be mapped out both in terms of the coherence of a domain of research, and in terms of the plurality of approaches they leave for investigation. It is the balance between these two features that determines the productivity of a particular domain of research at a given time.

One cluster of studies deals with the work of Carl Correns, from the restatement of Mendel's laws around 1900 to experimental sex determination. Another case study investigates the convergence of transmission genetics and developmental physiology. It is aims to provide a reconstruction of how Alfred Kühn and his collaborators, in particular Ernst Caspari, came to conceptualize gene-action chains involved in pigment formation in the flour moth Ephestia between 1925 and 1945. Another case study is devoted to the establishment of tobacco mosaic virus research in Germany, with Georg Melchers, Gerhard Schramm, Gernot Bergold and Rolf Danneel as its major protagonists. The most recent study in this context is concerned with the history of protozoology. It deals with Max Hartmann's fertilization, reproduction, and sexuality studies and their relation to genetics.

Cultural History of Heredity

The Structural Turn in 20th Century Biology and Anthropology

Staffan Müller-Wille (Research Scholar, MPIWG/Senior Researcher, University of Exeter, U.K.)

Staffan Müller-Wille

The project deals with one of the most contentious notions of 20th century biology, "race," and its changing relationship to genetics. Initially, genetics went against well-established notions in biology. In particular, it went against evolution and adaptation, and against orientation towards larger wholes such as races and species. In this respect, one can speak of a "structural revolution" which biology and anthropology underwent during the 20th century. Yet thinking in terms of race did not simply give way to a purely genetic understanding of life. The changing relationship of race and genetics over the latter part of the 20th century ranges from the outright rejection of race as a scientifically viable category by natural scientists in the UNESCO Statement of Race in 1951, to the recent upsurge of racial studies in the context of genomics.

The results of the case studies carried out by Müller-Wille point to a pattern familiar from the philosophy of science: the development of a field of enquiry from a qualitative, taxonomic approach to quantitative methods allowing for calculation. The important and remarkable point, however, is that such transitions are not smooth, but are characterized by resistance and ruptures. Moreover, they are not to be described as progress towards a more objective, value-free understanding of the subject of enquiry, in this case human diversity. On the contrary, the genetic understanding of human populations has provided even more powerful bio-political tools than racial biology could ever aspire to.

Cultural History of Heredity

On the History of Cloning. A Comparative Analysis of the Life Sciences in Germany Since 1950

Christina Brandt (Senior Research Scientist)

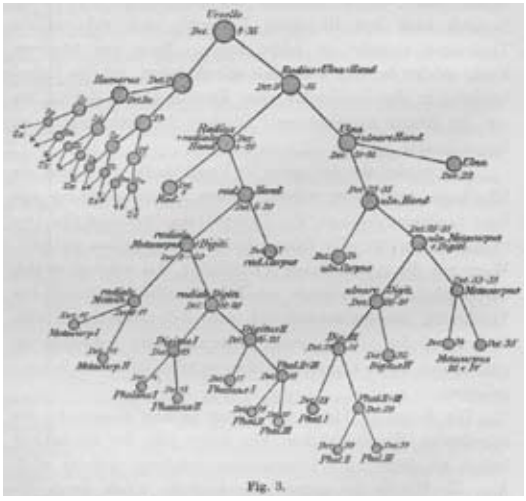
Christina Brandt

The project is aimed at uncovering the different scientific and cultural layers in the history of cloning. At the turn of the 20th century, the term "clone" was newly coined to designate plants that propagated in a vegetative manner from a common ancestor. During the 20th century, the concept passed through very different research areas, such as plant breeding, botany, cytology, tissue culture, cell lineage research, immunology, genetic engineering and developmental biology as well as reproductive medicine. The epistemic status of the clone also changed over time: The concept was first developed in the context of horticultural breeding, but the clone soon became something that could be called a technical object in different experimental systems throughout the 20th century. So far, the following areas have been investigated:

1. Protozoology in early 20th century, in particular the work of Herbert Spencer Jennings and Victor Jollos;
2. the history of nuclear transfer, in particular the work of Joachim Hämmerling, Robert Briggs and Thomas King, and of John Gurdon;
3. science fiction literature on cloning between 1960 and 1980.

The debate on cloning in the 1970s. Bild der Wissenschaft, Heft 7, cover, July 1979

Exploring the circulation of the term through different research areas, Christina Brandt's study addresses the relationship between material practices and concept formation within biological research. Furthermore, it deals with the images and phantasms that have been associated with the scientific practices of cloning since the early 1960s. The main subject matter of this part of the research consists of novels and science fiction. The history of cloning in (West-) Germany is compared to the situation in the U.S.A. and the U.K. Such a comparative perspective also raises the question of whether national research styles persisted in an increasingly internationally organized scientific landscape during the second half of the 20th century. One of the principal objectives of this project is to specify at which level national peculiarities may still be of relevance.



Weismann's theory of the "Keimplasma": differentiation of the "Idioplasma". August Weismann: Das Keimplasma. Eine Theorie der Vererbung, Jena, p. 136, 1892

Christina Brandt was appointed as Senior Research Scientist in the context of the Max Planck Society program for outstanding woman scholars by February 2006.

Cultural History of Heredity

Gardening, Fancying and Heredity

Jennifer Marie (Karl Schädler Postdoctoral Fellow, University College London, U.K.)

Jenny Marie

Jenny Marie investigated the relationship between breeders and geneticists in Britain between 1900 and 1940. The main focus of the project was on the links that existed between fanciers, economic breeders and geneticists that bred poultry and rabbits. Animal fanciers bred animals for exhibition, the aim being to gain prizes and prestige. The project looks at the differing social ideals that were embedded in the practices of breeding rabbits and poultry for display, and how this changed throughout the nineteenth and early twentieth centuries. Economic breeders bred animals for money —either by selling their animals for meat or for their by-products, such as fur, wool and eggs. The trade in breeding animals developed throughout the 19th and early 20th centuries. The project traces this development and analyzes how it was affected by world economic changes and wars.

In the project, these developments in breeding for fancy and economic gain are related to the rise of genetics as a scientific discipline. Many geneticists were also fanciers and some sold their excess animals to fund their research programs. Equally, economic breeders and fanciers needed some knowledge about heredity to breed exhibition winning animals and animals that would gain the highest price at market. This raises the question of what the boundaries were between these three groups of breeding practitioners. All three groups met up at international conferences, such as the World Poultry Congresses, and national events, such as the Harper Adams Poultry Conferences. At these events, they shared breeding knowledge, techniques and material. The project investigates how open each of the three groups' boundaries were to the other groups and how they controlled their boundaries.

The geneticist, Michael Pease, holding one of Lord Greenway's fancy Marans hens. From The Feathered World (30 October 1936): 447

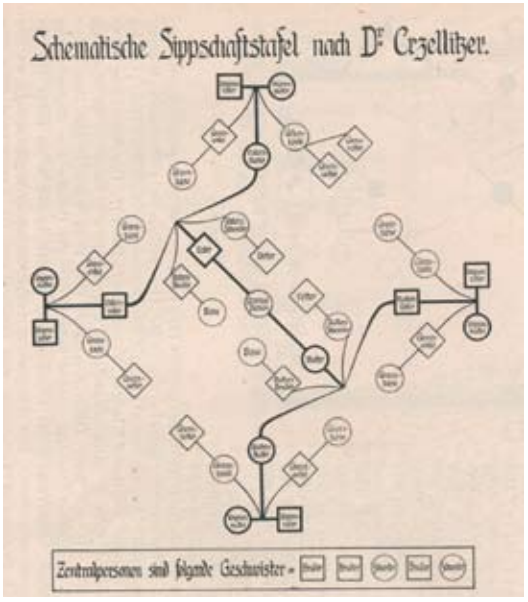
Cultural History of Heredity

Genealogy and Human Heredity in Germany, Late 19th and Early 20th Century

Bernd Gausemeier (Postdoctoral Fellow)

Bernd Gausemeier

All knowledge about human heredity is based on genealogy, but only in the 19th century did genealogy become a key method for the study of heredity. Animal breeders, plant breeders, physicians and psychiatrists all used genealogical systems to record or reconstruct information about hereditary transmission. Genealogy, thus, was the material basis for constructing knowledge about heredity in various scientific fields. Yet, genealogy is not only relevant as a scientific method. Its use also reflects prevailing ideas about familial and social order. Looking at genealogical practices can therefore tell us much about the political and social changes that were associated with the emergence of a science of heredity.



Genealogical record used for family research in medicine. Max von Gruber, Ernst Rüdin (eds.) Fortpflanzung, Vererbung, Rassenhygiene. Illustrierter Führer durch die Gruppe Rassenhygiene wder Internationalen Hygiene-Ausstellung 1911 in Dresden, München, 1911

Psychiatry is a particularly interesting field in this respect, since psychiatric asylums were the first institutions to record alleged hereditary phenomena on a regular basis. It was at the end of the 19th century, however, that genealogy was defined as an auxiliary science of biology and medicine. The central part of the project is concerned with the redefinition of genealogy in Germany around 1900. In his influential handbook on *Scientific Genealogy* (1898), historian Ottokar Lorenz defined genealogy as the bridge between historical and scientific research. Genealogical associations, by then mainly occupied with the mere collection of family records, began to join forces with psychiatrists and other medical scientists interested in the study of human heredity.

In the years before and after World War I, plans for genealogical collections filing family histories and medical data flourished. Genealogical surveys were regarded as the starting point both for a scientific study of human heredity and as a means of eugenic control. The interest in "biologized" genealogy culminated under the Nazi regime, when numerous eugenic databases were created and the right to live became virtually dependent on one's family chart.

Cultural History of Heredity

History of Radiation Biology and Genetics after 1945

Soraya de Chadarevian (Visiting Scholar, Department of History and Philosophy of Science, Cambridge University, U.K.)

Soraya de Chadarevian

During her research stay in Berlin, Soraya de Chadarevian pursued her research on the history of radiation biology and genetics after 1945. The research is part of a broader project aimed at studying the transformations of postwar biology. Studies on the effects of radiation on organisms and the environment and on the ways to protect against them, as well as the plethora of new tools derived from nuclear energy research whose peacetime uses in biology and medicine were actively promoted after the war, had a much broader impact on postwar biology than generally acknowledged. This research also provides a new perspective from which to view the relations of biology and physics and the role of biology in the nuclear age.

A particular line of research concerns the debate on the mutational effects of radiation that prompted various government reports and dominated much of the genetic research agenda after the war. Investigations aimed at tracing the mutational effect of radiation, and elucidating their mechanism included large-scale irradiation experiments with mice and other laboratory animals as well as perfecting methods for the study of human chromosomes. In the late 1950s, human chromosome analysis promised broad applications in clinical diagnostics. Following these lines of research offers a broader view on postwar genetics than is generally provided by the exclusive focus on DNA research and molecular biology. The debate on radioactive fallout from atmospheric bomb testing that fuelled concerns about the long-term genetic effects on the population also raised concerns on the contamination of the environment with radioactive isotopes and their accumulation in the human body. Research on these topics helps to unravel the intricate relationships between scientific, medical and political concerns in the postwar era.

Cultural History of Heredity

Representation and the Construction of Knowledge in Molecular Evolution

Edna Suárez-Díaz (Visiting Scholar, Universidad Nacional Autonoma de Mexico)

Edna Suárez-Díaz

The aim of the project is to develop an analysis of the production and representation of knowledge in the field of molecular evolution, since 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 on 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.

On 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 studies. It simultaneously opened and constrained the ways by which the evolution of organisms began to be studied and represented. By developing a new vocabulary, scientists such as Emile Zuckerkandl, Walter Fitch, Roy Britten and others 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 for the construction of trees based on molecular data on similarities by Walter Fitch, and the first databases on proteins by Margaret Dayhoff, as early as 1966, illustrate this point. The project emphasizes the symbiosis between computer technology, bioinformatics and genomics as a result of the Human Genome Project.

Cultural History of Heredity

Projects of the Short Term Guest Researchers

- *Jonathan Harwood* (University of Manchester): "Europe's Green Revolution: The Rise and Fall of Peasant-Oriented Plant-Breeding in Central Europe, 1890–1945"
- *Manfred Laubichler* (State University of Arizona, Tempe): "Heredity and Development as Related Problems—August Weismann and the Origin of Theoretical Biology"

Cultural History of Heredity

Activities Related to the Project

- Workshops:
  "A Cultural History of Heredity III: Nineteenth and Early Twentieth Centuries." Third International Conference of the project, Berlin, January 13–16, 2005.
  "History and Epistemology of Molecular Biology. Problems and Perspectives." International Conference organized in conjunction with the Institut Pasteur, Paris and the Société d'Histoire et d'Epistémologie des Sciences de la Vie, Berlin, October 13–15, 2005.
  "The Century of the Gene." One-Day-Workshop, Exeter, December 2, 2005.
- Books:
  Hans-Jörg Rheinberger and Jean-Paul Gaudillière, eds. *Classical Genetic Research and its Legacy*. London: Routledge, 2004.
  Jean-Paul Gaudillière and Hans-Jörg Rheinberger, eds. *From Molecular Genetics to Genomics.* London: Routledge, 2004.
  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. Cambridge: MIT Press, 2006 (in press).

Project

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

RESEARCH SCHOLARS *Uljana Feest, Hans-Jörg Rheinberger*
POSTDOCTORAL FELLOWS *Igal Dotan, Gábor Zemplén*
PREDOCTORAL FELLOW *Lambert Williams*

SHORT TERM QUEST RESEARCHERS *Thomas Dohmen, Giora Hon, Jutta Schickore*
COLLABORATIONS Philosophy Department, University of Haifa *(Giora Hon)*, Historisches Seminar, Universität Wuppertal *(Friedrich Steinle)*, Department of History and Philosophy of Science, Indiana University Bloomington *(Jutta Schickore)*
FUNDING German-Israeli Foundation, MPIWG

The project consists of two working groups. One of them is 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. It is supported by the German-Israeli Foundation. In order to facilitate and implement the exchange and cooperation among all group members, there are regular meetings bringing together the local groups at Haifa and Berlin, and in which the progress of individual projects and relevant literature are discussed. Moreover, in order to integrate the two groups, three workshops were planned in which individual works in progress are presented. The first took place in Haifa in May 2005, the second in Berlin in June 2006.

Experimentation, a core procedure of modern science, has received new attention in history and philosophy of science in the last two decades. While a wealth of new perspectives have opened up, one essential feature has remained largely unanalyzed—the very role of experiment as a *knowledge-generating* procedure. Here is where the project starts off. It is aimed to develop a broader philosophical and historical understanding of how knowledge is gained, shifted and revised in experimental research. The links and dynamics between three focal issues are being explored: experimental systems, concept formation, and the pivotal role of error.

Challenging the clear-cut rationalist picture of experiment, Ludwik Fleck and others early on drew attention to the manufacture of scientific facts, arguing that modern scientists, as a rule, do not deal with single experiments in the context of a properly delineated theory. Experimental scientists deal with clusters of experiments that are usually not well defined and do not provide definitive answers. In a permanently

changing and varying pattern, experimental systems combine elements which historians and philosophers of science have long sought to separate: Research objects, theories, technical arrangements, instruments as well as disciplinary, institutional, social, and cultural dispositifs. In addition to looking at such assemblages, an analysis of how different experimental systems interact will provide insight into the developmental dynamics of broader fields of science.

Focusing on the details of experimental practice, recent studies have made clear that, in order to account for the epistemic variety, one needs to differentiate several levels of conceptualization. Experiment is only possible by relying on certain instruments, procedures, and concepts that are taken as unproblematic. At the same time, scientific activities and conceptualizations are in constant attunement to each other as the experimental process unfolds. Focusing on these processes, a specific type of experimentation becomes delineated: the exploratory experiment. It follows distinct guidelines and epistemic principles. In many cases, moreover, it leads to the revision of existing concepts and the formation of new concepts that creates a stable and general expression of the experimental results. The study of concept formation in experimental contexts promises new insights into the epistemic dynamics of experimental research.

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" may mean is huge and has so far only insufficiently been studied under an epistemological perspective. At the same time, we might gain significant insight into the epistemic dynamics of experiment by asking what constitutes an error within an experiment. There is a close connection between epistemological framework and methodological approach on the one hand, and the detection and characterization of error on the other. Furthermore, what counts as an error is as much dependent on the individual experiment as on the wider system in which it has been designed and conducted. Again one is directed away from the individual experiment to a broader system. To explain the underlying phenomenon of error, the very structure of the system has to be taken into account. Studies of error can therefore demonstrate how the system functions.

Generating Experimental Knowledge

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

Uljana Feest (Research Scholar)

Uljana Feest

Uljana Feest's research is divided into three—partially overlapping—projects. The first is on the relationship between the emergence of Gestalt psychology and the philosophical movement that later became known as "logical positivism" or "logical empiricism" during the time of the Weimar Republic. The second project looks at the historical context of the emergence of the dichotomy between *Erklären* and *Verstehen* in philosophical and scientific debates about the role and approach of the human sciences. Finally, Uljana Feest looks at epistemological issues in the history and philosophy of 20th century psychology and neuroscience.

The issue of the relationship between methodological and conceptual decisions lies at the heart of all three projects. Within the project on Generating Experimental Knowledge, Feest has been working on a book project, entitled Operationism, Experimentation, Concept Formation. In it, she focuses on the methodological concept of operationism within psychology. The concept itself has a history that she traces back to early 20th century American psychology. However, apart from history, Feest is also interested in the ways in which the concept might be used to address systematic questions that have been raised within epistemology of experimentation. The thesis underlying the work is that all experiments require an operationalization, and that operationalizations require some presuppositions about the subject matter under investigation. While scientists frequently refer to such presuppositions as "definitions," Feest shows in her work that such definitions have a pragmatic and temporary status. They can alter as the research proceeds. The thesis is developed and illustrated by means of a case study that looks at research on the purported phenomenon of implicit memory within cognitive psychology and neuropsychology from the early 1980s to the mid 1990s.

Generating Experimental Knowledge

Science in Crisis and Progress

Igal Dotan (Postdoctoral Fellow, University of Haifa, Israel)

Igal Dotan

The project is a philosophical and historical case study of the experimental exploration of the evolutionary theory of aging. This research program was initiated in the late 1970s by Michael Rose and Brian Charlesworth, a prominent evolutionary biologist from the University of Sussex. They were stirred by a bold yet poorly studied theory of organismal aging put forward by Peter Medawar and George Williams. According to the theory, aging is the consequence of the declining force of natural selection with age. Late life deleterious mutations escape selection, accumulate and cause the protracted overall decline of bio-performance.

The system designed by Rose was based on experiments in which populations of fruit flies are subjected to various kinds of selection regimes. However, as is often the case with new experimental systems devised to explore a yet unstudied phenomenon, it soon became clear that in spite of carefully crafted conditions the new system yielded contradictory data and was riddled with artifacts. After more than two decades of selection experiments with *Drosophila*, participants agree that a great deal was learned, and that at the same time much remained highly questionable.

The picture revealed by the historical study seems to be at odds with the widely accepted empiricist view of scientific research that equates scientific knowledge with empirically justified information. The philosophical analysis of the episode follows Karl Popper's basic idea according to which explanation and confirmation, *qua* scientific aims, are in methodological conflict. In order to initiate and to maintain a research program researchers are often willing to sacrifice empirical adequacy for explanatory depth. Two eminent critics of Popper have characterized and studied this "bootstrapping" dynamics: Joseph Agassi and later Mario Bunge. In his case study, Dotan employs the bootstrap operation view to show how programmatic thinking and action interact in experimental work to produce scientific knowledge that is controversial *and* progressive.

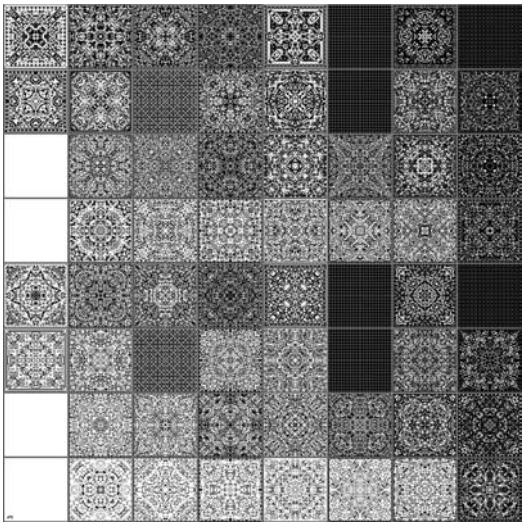
Generating Experimental Knowledge

Complexity, Computation, and Virtual Experiment, 1960–2000

Lambert Williams (Predoctoral Fellow, Harvard University, U.S.A.)

Lambert Williams

Thinking that the world is governed by natural laws written in mathematical language has a long, venerable and complicated history. But what sort of laws? For Galileo at least, it was obvious that God had not only written the universe in mathematical language, but that conceivably this language would be *simple*. Down to today, this idea that the universe might be fundamentally simple, whether at the level of grand cosmology or of minute quanta, has persisted. And yet alongside this, another vision has emerged which the project of Lambert Williams aims to disentangle. This is a vision which considers that certain systems—and examples run a heterogeneous gamut from ant foraging, to brains, to cities, to financial markets—have in some way an irreducible dimension of *complexity*. This all-important yet slippery word, taken from everyday language and not lending itself to any obvious formal definition, has given rise to a range of responses. Some have verged on mysterianism: Physicist Eugene Wigner, writing in 1960, asserted that 'the world around us is of *baffling complexity* and the most obvious fact … is that we cannot predict the future.' Yet whereas some have read an impediment, others sensed an opportunity. There is by now a community—counting among its members such people as Doyne Farmer, John Holland, and Stuart Kauffman—who are interested precisely by the lack of any tight definition, and are drawn in by the deep potential for bafflement; such depth is deemed worthy of a new science. Approaching the big question of complexity by reference to further notions such as emergence, feedback and organization, and often relying heavily on the computer, they and other researchers at such institutions as the Santa Fe Institute have attempted to launch a concrete science of complexity. Framing the emergence and dispersion of complexity science from 1960 to 2000 as a 'quasi-discipline,' Williams's project insists from the outset that attention be paid to connections between this new archipelago of ideas and what arguably are the indispensable aspects of both computational practice and virtual experiment. At root, this dissertation studies mathematical modeling techniques as inextricably tied to the tools available.



64 elementary bi-dimensional binary cellular automata with 1 white central starting point. (Copyright granted by Jean-François Colonna, CMAP (Centre de Mathematiques Appliquées)

Generating Experimental Knowledge

Experimentation and Experimental Error in Scientific Debates and in the Area of Generative Linguistic

Gábor Zemplén (Postdoctoral Fellow, Budapest University of Technology and Economics, Hungary)

Gábor Zemplén

In connection with the research group "Generating Experimental Knowledge," Gábor Zemplén has been exploring the epistemological relevance of experimentation and experimental error in disciplines where the historical development of the field has not prepared the researchers for tackling the difficulties arising from the process of experimentation. He has written and co-authored articles on the assessment and interpretation of experimentation and experimental error in the area of generative linguistics (or biolinguistics).

Concerning his main research topic at the MPI, he has been studying the use of experimental descriptions as arguments in scientific debates, especially the 17th century debate around modificationist theories of color and Newton's theory of light and colors.

Generating Experimental Knowledge

Projects of Short Term Guest Researchers

- *Thomas Dohmen* (University of Haifa, Israel): "Context and Error in the Epistemology of Scientific Experiment"
- *Giora Hon* (University of Haifa, Israel): "History of the Concept of Symmetry"
- *Jutta Schickore* (University of Indiana, Bloomington, U.S.A.): "Revisiting Discovery and Justification: The Context Distinction in Historical and Philosophical Perspective" (Book project with Giora Hon and Friedrich Steinle)

Activities Related to the Project

- Workshops:
  First Group Meeting, Berlin, July 12–13, 2004.
  Second Group Meeting, Berlin, December 6–7, 2004.
  "Error in Experimental Science" Workshop, Haifa, May 8–10, 2005.
  Third Group Meeting, Berlin, November 25–26, 2005.
- Book:
  Giora Hon, Jutta Schickore, and Friedrich Steinle (eds.), *Going Amiss*. Cambridge: MIT Press, in press.

Individual Projects of the Department

Project

The Senses of the Observer

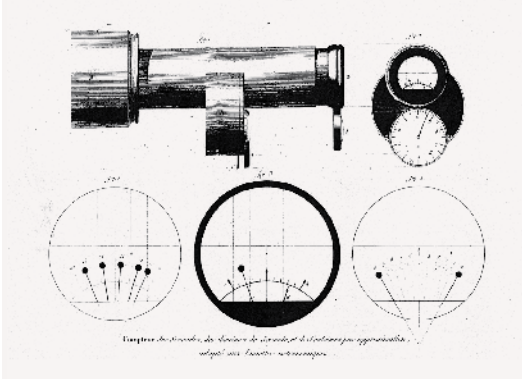
Christoph Hoffmann (Research Scholar)

Christoph Hoffmann

The research project focuses on the conceptualization of the human senses in different practices of observation during the period between 1750 and 1830. The domains analyzed include the measuring procedures in optics (photometry), astronomy (transit observations, determinations of longitude), and physiology (duration of the afterimage; acuity of the sense of touch). The resulting book *Unter Beobachtung* (Göttingen: Wallstein Verlag, 2006, in press) rests on three major arguments.

A fundamental shift in the understanding of the senses took place at the beginning of the 19th century. In the century before that, the use of the senses in observation was primarily conceptualized in terms of training, education, the correct application of appropriate methods, and an awareness of inadequate conclusions from the judgment of the senses. At the beginning of the 19th century, the emphasis was placed on unconscious errors due to the functioning of the sense apparatuses themselves. This shift was closely related to a transformation in the apprehension of scientific instruments.

As a consequence, a new regime of control was established. It was oriented toward the measurement of the errors stemming from both the instruments of observation and the senses of the observer, partly by means of mathematical reckoning, and partly by means of special routines of experimentation and observation. Both the instruments of observation and the senses of the observer were practically handled in the same way in the new regime of observation. The senses were defined as apparatuses whose errors could be calculated in the very same manner as the errors produced by clocks or telescopes.



Compteur des Secondes, des dixièmes de Seconde, et de Centièmes par approximation adapté aux Lunettes astronomique (Abraham-Louis Breguet). Annales de Chimie et de Physique, Vol. 10, 1819

From this point of view, the conceptualization of the human senses with respect to functions of instruments and technologies

such as telegraphy, telephone, or photography, which dominated the research practice in sensory physiology in the second half of the 19th century, appears in a new light. Broadly speaking, the symmetrical approach to the senses and the instruments of observation created the ground for a new type of experimentation, in which instruments and apparatuses became physically comparable to sensory functions and vice versa.

Project

Epistemic History of Children's Drawings, 1880–1930

Barbara Wittmann (Postdoctoral Fellow, Universität Trier, Germany)

Barbara Wittmann

The research project investigates the emergence of the scientific interest in children's drawings and their instrumentalization as diagnostic tools between the late 1880s and the 1920s. Before 1880, children's drawings were not considered to be of any aesthetic or heuristic value. Soon after, they became a major diagnostic device in psychological analysis. Barbara Wittmann tracks the successive interest that psychologists, pedagogues, historians and art historians took in children's drawings as scientific objects and psychological instruments. In three case studies, she focuses on the various kinds of methods, techniques and tests developed to "read" what had theretofore been regarded as "meaningless."

Georg Kerschensteiner: Die Entwickelung der zeichnerischen Begabung, München: Gerber, plate 37, Library B. W., 1905

The first case study deals with the very emergence of children's drawings as *scientific objects*, namely with the earliest publications on and exhibitions of children's drawings, such as the exhibition "Das Kind als Künstler" (Hamburger Kunsthalle in 1898) and the writings of the art historian Corrado Ricci, the psychologists Bernard Pérez and James Sully, and pedagogues such as Ebenezer Cooke and Georg Kerschensteiner. The collection and exhibition of children's drawings were not only the major tools by which their "discovery" was materially accomplished, but also a formative epistemological condition. Through the order and virtual analysis of the *tableau* the "art of little children" underwent a process of purification and preparation which enabled its instrumentalization as an experimental and diagnostic instrument.

The second and third case studies investigate the implementation of the drawing child in psychological experiments and tests. In the laboratories (and nurseries) of James Mark Baldwin, William Stern and Ernst Meumann, the scribbling of infants was used to explore the functional cooperation of eye, hand and mind, the development of the spatial perception or the origin of handwriting. Children's drawings were

considered to act as embodied curve plotters visualizing and recording psycho-physiological functions at the same time. The practical definition of scribbling as *écriture automatique* became a major condition for its use as diagnostic tool in psychometrics and psychoanalysis.
In the 1920s, the "artistic production" of children was finally believed to reveal hidden secrets, to show proof of the child's intelligence and social development, to document its psychoanalytic dispositions and symptoms. This typically modernist paradigm was not only the product of the rapid accumulation of knowledge about drawing children, but also a consequence of an experimental set-up of which scribbling had become part in the laboratories of psycho-physiology around 1900.

Project

Müller's Lab

Laura Otis (Visiting Scholar, Emory University, U.S.A., McArthur Fellow)

Laura Otis

"Müller's Lab" is an interdisciplinary book that combines the research techniques of the history of science with those of literary analysis. In this multi-perspective study of science in Berlin, 1833–58, Laura Otis compares seven renowned scientists' descriptions of their advisor, Johannes Müller. Jakob Henle, Theodor Schwann, Emil du Bois-Reymond, Hermann von Helmholtz, Rudolf Virchow, Robert Remak, and Ernst Haeckel left very different portraits of Müller, and by studying their reasons for representing him as they did, Otis aims to show how scientists' ongoing work and career choices have colored their accounts of the past.

To produce a picture of each scientist's own work as well as his representation of Müller, Otis is using personal letters, published and unpublished, scientific writings, and, when available, statements about Müller in eulogies and popular lectures. Historians Gabriel Finkelstein and Nicholas Jardine have noted how Emil du Bois-Reymond and Rudolf Virchow consciously shaped their narratives of Müller to serve their own academic interests, but until now, no historian has systematically compared multiple accounts of one advisor to demonstrate how scientists' personal interests have created the history of science.

By juxtaposing seven successful scientists' accounts of their advisor, however, "Müller's Lab" offers much more than narrative analysis. A second aim of the project is to show how personal interactions among scientists affect their decisions about which fields to enter and which experiments to undertake.

Project

The Popular Science Book: A New Genre Between Literature and Science in the Late 19th and Early 20th Century

Safia Azzouni (Postdoctoral Fellow)

Safia Azzouni

In Europe, popular science books emerged during the second half of the 19th century. The project explores the role these books played in the transfer—and the production—of knowledge. By studying the different ways of writing popular science around 1900, Azzouni's aim is to trace the interaction of experts, amateurs and laypeople. Popular science books were not only written by scientists who wanted to make their work accessible to a broad public, but also by literary authors. Accordingly, the question arises to which extent the genesis of the popular science book is linked to the literary movements of the time.

Over the course of the 19th century, the interest that writers took in scientific experimentation and innovation constantly increased. The French critic Hippolyte Taine established a positivist literary theory by naming "la race, le milieu et le moment" as determinants of human life and artistic production. His reference to Darwinism is obvious. Emile Zola modeled his theory of the "Roman Expérimental" upon Claude Bernard's "Médecine Expérimentale." The French naturalistic movement in turn influenced German literary circles. Literary naturalism reinforced the claim to truth and objectivity already pronounced by realistic writers like Honoré de Balzac and Theodor Fontane.

Title page of "Vom Bazillus zum Affenmenschen" (1900), one of Wilhelm Bölsche's numerous popular scientific publications. Wilhelm Bölsche: Vom Bazillus zum Affenmenschen. Naturwissenschaftliche Plaudereien. Leipzig: Diederichs, 1900

Along with these movements, various means of popularizing natural science developed in Europe due to political and educational views. Several writers engaged in this enterprise. Azzouni's research project is centered upon exemplary case studies from the continental context of popular science. Through a close reading of popular science writings, she attempts to reveal patterns and techniques of communicating science as well as their preconditions. Among the writers dealt with in this project are the theorist of naturalism Wilhelm Bölsche, the mathematician, physicist and philosopher Kurd Laßwitz, the Belgian symbolist dramatist Maurice Maeterlinck, and the naturalist writer Johannes Schlaf.

Project

The Uses of Theory in Studies of Brain and Mind, 1930–1960

Tara Abraham (Postdoctoral Fellow, University of Toronto, Canada)

Tara Abraham

Tara Abraham's postdoctoral project was concerned with the emergence of theoretical methods in studies of brain and mind in the U.S.A. during the twentieth century. The use of theory in this context was connected to debates about the complexity of biological phenomena, the autonomy of biology from the physical sciences, and arguments about the unity of the sciences. Many physicists, mathematicians and cyberneticians saw the complexity of living processes—particularly those of the central nervous system—as justification for the use of mechanical analogies and theoretical methods to address problems in the life sciences.

The main focus of the project was on the work of cybernetician Warren S. McCulloch. It investigated the transdisciplinary nature of the cybernetics movement and the power and controversy surrounding the cybernetic discourse that emerged during the 1940s and 1950s in the American context. At the heart of this discourse was the concept of negative feedback. Negative feedback served to unify the physical and the biological: cyberneticians saw goal-directed behavior as a shared property of certain types of machines and organisms, and the underlying mechanisms in their purposeful behavior were seen to involve negative feedback. With their characterization of negative feedback as a concept common to physical, biological, and social systems, cyberneticians aimed to transcend disciplinary boundaries, and McCulloch exemplifies this movement.

Project

Electronic Imaging and Cell Biology, 1945–1995

Nancy Anderson (Rathenau Postdoctoral Fellow, Stanford University, U.S.A.)

Nancy Anderson's postdoctoral project was devoted to a study on electronic imaging and cell biology, 1945–1995. The first part of the study covers the 1950s and the introduction of the television-microscope—the precursor to video microscopy—as well as initial uses of the computer for cell sorting and the development of pattern recognition programs. It is introduced by a discussion of the interwar uses of electronics (photomultipliers) in research on cells. The second part covers electronic instrumentation introduced to cell biology in the 1960s, such as the image intensifier and digital computing programs. It focuses on media shifts from photography and cinema to video and the rise of systematic image processing in the laboratory. The study of systems for analyzing living cells is of central interest in the project.

Another part of the study has been devoted to the history of Green Fluorescent Protein (GFP) as the first successful transgenic fluorescent reporter molecule. This study begins with a description of various applications of bioluminescence in experimentation and as biological assays in the interwar period, and then concentrates on the discovery of GFP in a jellyfish in the 1960s and the first experiments introducing the protein's gene into exogenous genomes in the 1990s. It addresses the success of fluorescence light microscopy during the second half of the 20th century, but also emphasizes that the meager light offered by these fluorophores could not have made such crucial contributions to cell biology without the assistance of electronic imaging systems.

Project

Minimum Measures

Dana Simmons (Postdoctoral Fellow, University of Chicago, U.S.A.)

Dana Simmons

Dana Simmons's postdoctoral research project explored the intersections between science and economy in modern France. It focused on a new paradigm for measuring the human economy: the minimum standard of living. In the late 19th and early 20th centuries, a complex of concepts emerged for quantifying and normalizing life functions. Minimum standards fixed quantities of food, air and other consumer goods deemed necessary to sustain life. The project developed the claim that by the twentieth century, a wide field of measurement and intervention focused specifically on the consuming body. Its practitioners shared a common program: to maintain bodily functions at the lowest possible expense of goods and money. Consumption and waste became the object of intensive scientific optimization.

Minimum measures inflected many facets of daily existence: dietary standards and school lunch programs, building codes and migrant housing, need-based welfare and the poverty line. Within this landscape, the project examined the history of four strategic fields: the science of nutrition, wartime rationing, the minimum wage, and domestic architecture. Chemists formulated scientific standards for dietary intake and breathable air. State administrators quickly grasped these measures and applied them to non-productive, institutionalized populations in schools, hospitals and prisons. By the 1950s, minimum wage laws exposed the national working population to state-organized consumption.

Project

Sciences of the Soul and Mind in France, Late 19th and Early 20th Century

Sofie Lachapelle (Postdoctoral Fellow, University of Notre Dame, U.S.A.)

Sofie Lachapelle

During her postdoctoral stay, Sofie Lachapelle worked on a number of case studies in the context of her project. The first was on the nineteenth-century Belgian stigmatic Louise Lateau (1850–1883), her phenomena and interactions with both the Church and the scientific community. More generally, she explored the scientific scrutiny under which such physical manifestations of religiosity were put in the second half of the nineteenth century. The study deals with the authority of physiological and pathological explanations in the face of religion, and tells a story of people caught between faith and science, between miracle and sickness.
The second case study focused on the creation and early years of the Institut Métapsychique International (IMI). In 1919, the IMI held its first meeting in Paris. With their choice of a name, the founders made their intentions clear; by using the term *métapsychique* rather than the more commonly used *sciences psychiques,* they indicated a departure from previous enterprises of such kind in France. The study analyzes the first twelve years of the IMI in its attempts to impose a program of research and to incorporate psychical phenomena into the scientific corpus in specific ways.

The third case study concerned the schools that were developed for idiots in 19th-century France. It deals with the treatment of idiots in the alienist circles from the perspective of the relationships between the educational theories and both the physical places and structural organization from which they emanated and to which they led. If only a few alienists encouraged the education of idiots at the beginning of the nineteenth century, with time, more sophisticated methods of instructing idiots and more specific ideas on the goals that could be attained in such an enterprise were enunciated.

Project

History and Anthropology of Premature Babies Care in Post WWII France

Olivier Thiery (Postdoctoral Fellow, Ecole Nationale Supérieure des Mines, Paris, France)

The research project concerns the contemporary history and the ethnology of the care of premature babies—a part of which is called "neonatology"—in France. The project has a historical and an anthropological part. The main purpose of the historical work is to identify the genealogy of the construction of a medical object: the

premature baby. Already during the first part of the 20th century, obstetricians—in France, Germany, and the United States—took care of very low birth-weight infants. Feeding, thermoregulation in the first incubators, and prevention of infections were the main aspects of their care during this period. However, it is only after the Second World War that the premature baby emerges as an object in itself. With a new definition, by age and not by weight, a new alliance between research in physiology and clinics became possible.

The second part of the project consists in an ethnological fieldwork of four months in a French Neonatal Intensive Care Unit for premature babies, using the methods of micro-sociology (observations, discussions, analysis of documentation). At a first level, this inquiry aims to realize an extensive description of the daily care of premature babies. At a second and more problematic level, by following some cases in detail, the project serves to characterize the care of premature babies as a risky experimentation with life.

Upcoming Project

In the fall of 2006, a new project on "Emerging Knowledge—Drawing and Writing as Research Procedures" will be launched. The project will be directed by Christoph Hoffmann and Barbara Wittmann. Part of the funding will be provided by the Fritz Thyssen Stiftung. The project will investigate the activities of drawing and writing as knowledge-directing procedures characteristic of modern science. It starts from the premise that the highly variable interactions of hand, pencil, and paper do not merely serve to secure what is already there in thought, but also to engender knowledge effects that are closely bound to the procedural practices of drawing and writing. Even in the age of technoscience, simple sketches and notations continue to mediate between perception and reflection, between securing facts and the generation of hypotheses. As means of representation, they delineate the critical domain of preliminary and probing action in which more or less stabilized facts arise from raw data that are more or less opaque. This process in which objects of experience are formed in the very act of writing and drawing shall be analyzed in exemplary case studies spanning from the sciences and the humanities to literature and art (ca. 1750 to 2000).

Short Term Visits of Former Fellows and Their Projects

- *Rodolphe Gasché* (State University of New York at Buffalo, U.S.A.): "Jan Patocka's Care of the Soul and Edmund Husserl's Lebenswelt"
- *Birgit Griesecke* (Universität Bonn, Germany): "The Foreignness of Science"
- *Jens Lachmund* (Universiteit Maastricht, The Netherlands): "The Making of an Urban Ecology. Biology and Wildlife Protection in Post WWII Berlin"
- *Andreas Mayer* (University of Cambridge, U.K.): "The Study of Human and Animal Locomotion Systems: Rise and Fall of Etienne Jules Marey's Physiological Station"
- *Alexandre Métraux* (Universität Mannheim, Germany): "Art Machines"

Other Short-Term Visitors

- *Jenny Beckman* (Uppsala Universitet, Sweden): "Crossing Borders in the Kingdoms of Nature: Amateurs in Science"
- *Rüdiger Campe* (Johns Hopkins University, Baltimore, U.S.A.): "Procedures and Techniques of Writing and Notation in the 17th and 18th Centuries"
- *Markus Christen* (Universität/ETH Zürich, Switzerland): "History of Neural Coding and Neural Computation"
- *Paul Forman* (Smithsonian Institution, Washington, DC, U.S.A.): "Apprehending Postmodern Science"
- *Tania Munz* (Princeton University, U.S.A.): "Of Birds and Bees: Karl von Frisch, Konrad Lorenz and the Science of Animals in Germany"
- *Jahnavi Phalkey* (Georgia Institute of Technology, U.S.A.): "History of Scientific Instruments and Practices in India, ca. 1930–1970"
- *Christina Ratmoko* (Universität Zürich, Switzerland): "The Essence of Femininity and Masculinity: The Industrial Making of Sex Hormones and their Therapeutic Use from 1910 to 1940"
- *Alexander von Schwerin* (Research Program "History of the Kaiser Wilhelm Society in the National Socialist Era"): "Radioactivity and Biological Research in Germany, 1920–1970"
- *Leo Slater* (Johns Hopkins University, U.S.A.): "History of Malaria Chemotherapy in the 20th Century"
- *Heiko Stoff* (Research Program "History of the Kaiser Wilhelm Society in the National Socialist Era"): "Research on Enzymes, Hormones, and Vitamins in Germany, 1920–1970"

From the "Chemical Museum" at Leeds, founded in 1874 (courtesy of the University Collection, University of Leeds.)

Independent Research Group I

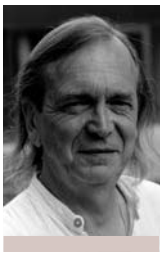
History and Philosophy of Laboratory Sciences

Director: *Ursula Klein*

Project 1

Materials in the History of Science and Technology (ca. 1600–1850)

Ursula Klein, Andrew Pickering, Maria Rentetzi, Leo Slater, Andrew Sparling



Andrew Pickering

Maria Rentetzi

Leo Slater

Andrew Sparling

In the past two decades, historical studies of the relations between the experimental and observational sciences and the arts and crafts, or technology, have placed instruments at the forefront of historical inquiry. Such studies, as well as more general accounts of the reconfiguration of learned knowledge and practice from the seventeenth century until the nineteenth century, have demonstrated the extent to which the generation of learned natural knowledge crucially depended on instruments understood as resources constructed out of, and working upon, wider technology and society. The project "Materials in the History of Science and Technology" shifts attention towards a new kind of material objects: raw materials and substances processed in the workshop and laboratory. Well into the nineteenth century metals, salts, dyestuffs, gunpowder, ceramics, porcelain, glass, vegetable substances, alcoholic liquors, mineral waters and so on were simultaneously commodities and objects of scientific inquiry. As they were objects shared by artisans and savants, they had many different

significances and uses, according to how they were deployed in different practical or epistemic contexts. Traveling from sites of commercial production and consumption to academic institutions, and vice versa, they spurred the generation of both learned (or scientific) and artisanal (or technological) knowledge.
Focusing on materials, the project further moves from institutions and activities that have been unambiguously viewed as typical of "experimental philosophy" towards sites at which the practice of the arts and crafts intersected with many different types of learned culture. This dual shift broadens our notion of material culture by taking materials seriously as the subject of historical knowledge, and further suggests some revisions to the standard historical picture of the emergence of the natural sciences. A viewpoint still powerful within the field of history of science, which situates experimental philosophy and the history of physics at the center of attention, is replaced here by a decentered approach that takes into account a broader range of forms of making and knowing in the history of science and technology, including natural history, chemistry, pharmacy, and medicine. All of these latter cultures resist clear categorization under the rubric of "experimental philosophy." By analyzing the making, uses and meanings of materials between 1600 and 1850, the project examines how different cultures of natural history, experimental history *(historia experimentalis)*, and experimental philosophy intersected with artisanal labor and craftsmanship and with practices of commerce and consumption.

Book

(by *Ursula Klein* and *Wolfgang Lefèvre*, Department I): *Materials in Eighteenth-Century Science: A Historical Ontology.* Cambridge, Mass. and London: MIT Press, in press

The book presents a novel approach to the history of scientific objects in general, and the history of chemistry in particular. It interweaves three historical and philosophical themes: ontologies of materials, practices of identifying and classifying materials, and the science of materials from the late seventeenth century until the early nineteenth century.
In the eighteenth century the science of materials was chemistry. Though learned inquiries into materials also took place in mineralogy, botany, architecture, engineering, pharmacy and a few other areas, chemistry was the only scientific culture in the eighteenth century where materials were studied persistently, comprehensively, and from multiple perspectives. The material substances studied by eighteenth-century chemists were for the most part commodities procured, sold, or tested in apothecary's shops, foundries, assaying laboratories, arsenals, dyeing manufactories, distilleries, coffee shops and so on. Even the few substances that were genuine inventions or discoveries of the academic laboratory were soon transferred to the mundane world, where they found application as remedies and other goods. But chemists also studied substances as natural objects that carry imperceptible features. They invested commodities with new meaning when they ordered them according to natural origin, analyzed their invisible components, and explored their affinities in chemical transfor-

mations. In so doing, chemists constituted objects of scientific inquiry that reached out to cultures of natural history and experimental philosophy.

Eighteenth-century chemistry often has been studied as a science of atoms, corpuscles, and Newtonian forces. In contrast, the authors' approach depicts the chemistry of that period as a science of materials. They argue that chemically processed substances and natural raw materials played such a central role in eighteenth-century chemistry because they lent themselves to multifarious ways of inquiry: descriptive (in the *historia* tradition), technological, and philosophical. Historical studies of materials allow a new grasp of issues traditionally highlighted as characteristic of the science of chemistry—composition, affinities and similar entities akin to the imperceptible objects of experimental philosophy—alongside themes traditionally treated as characteristic of natural history and as centerpieces of chemical technology. A larger picture of chemistry from the late seventeenth century until the early nineteenth century is obtained, outlined with broad strokes but extending from its mundane artisanal practices to experimental and natural histories, all the way to conceptual or philosophical inquiry. Eighteenth-century chemical substances were multidimensional objects that were investigated in practical and theoretical contexts, and amalgamated perceptible and imperceptible, useful and philosophical, technological and scientific, social and natural features. Their many faces challenge our current predominant philosophical and historical understanding of scientific objects, which sets apart objects of scientific investigation from objects of technological inquiry, and objects of a descriptive natural history from objects of explanatory natural philosophy.

The book's main approach to eighteenth-century chemists' ontology of materials is the scrutiny of their practices of identification and classification. Identifying and classifying things are human activities that structure the world by ordering single things into kinds of things and by establishing relationships between the different kinds. Studies of classifications inform historians of what types of objects were handled in the past and how the historical actors understood these objects; that is, they lay bare the rough ontological structures of the past. In the course of the eighteenth century, chemists' ontology of materials shifted in various ways in keeping with changes in their classificatory practices. For example, until the middle of the eighteenth century chemists regarded plant materials primarily as remedies; in keeping with pharmaceutical classification they ordered plant materials into two different classes, namely, the pharmaceutical simples purchased from merchants, such as sugar, camphor, natural balsams, wax, gums, and resins, and the chemical remedies prepared in their laboratories, such as distilled oils, distilled waters, extracts, and essential salts. Around the middle of the eighteenth century they epistemically elevated plant materials as compound components or proximate principles of plants, while grouping together the pharmaceutical simples and the chemical remedies into the unified class of proximate principles of plants. Some four decades later they began to highlight "organic substances" created by processes of life, grouping together proximate principles of plants and of animals. Yet beginning in the late 1820s many of these early organic substances, such as balsams, distilled vegetable oils and animal fats, disappeared from chemists' agenda, and were replaced by a new type of scientific objects, namely the stoichiometrically pure carbon compounds that were classified according to chemical composition and constitution represented by chemical formulae.

A striking result of the research on eighteenth-century chemical materials was the discovery of just how diverse eighteenth-century chemists' classificatory practices were. Eighteenth-century chemists did not order materials under a single conceptual umbrella or paradigm, and they did not create one comprehensive taxonomic system. Apart from the many different ways of classifying materials in contexts of technological inquiry or "applied chemistry," the book highlights two main differences in their ways of classifying materials in contexts of conceptual investigation: classification according to chemical composition, and classification according to provenance and perceptible properties. This striking difference in eighteenth-century chemists' mode of classification of materials informs the organization of the book and its division into two main parts—part II analyzing the domain of materials classified according to chemical composition, and part III studying plant materials classified according to natural origin, way of chemical preparation, and perceptible properties. A long introductory part I tackles historical and philosophical questions concerning the kinds of materials studied by eighteenth-century chemists, chemists' collective practices of studying these objects, and the uses of studies of classification for historians and philosophers of science. In a final conclusion we examine the role played by materiality for the existence and maintenance of the major difference in chemists' order of materials.

Speaking of eighteenth-century chemistry almost inevitably brings up the theme of the chemical revolution. The Lavoisierian chemical revolution of the last third of the eighteenth century has been one of the most debated themes in the history of chemistry. It also spurred controversies in the history and philosophy of science more broadly. If the assumption is right that eighteenth-century chemical substances were multidimensional objects of inquiry, which invited chemists to switch from studies of perceptible properties and commercial uses to studies of imperceptible features, the book's approach should also provide new insight into this crucial historical event. This is indeed the case. The two main historical studies presented in parts II and III of the book—the classification of pure chemical substances in the *Méthode de nomenclature chimique* of 1787, which has always been regarded as a central achievement of the chemical revolution, and chemists' classification of plant materials before and after c. 1790—challenge the current understanding of the chemical revolution. Seen from our new perspective, Lavoisier and his collaborators reaped the rewards of a century. In so doing, they introduced reforms of concepts, theories, analytical methods, and language. Yet they neither initiated an ontological rupture nor overthrew the existing taxonomic structure of their main objects of inquiry, the chemical substances. Chemists continued to live in largely the same world of objects of inquiry before and after the Lavoisierian reforms. Well into the nineteenth century, in large areas of chemistry, especially plant and animal chemistry, modes of individuating, identifying and classifying substances were similar to artisans' and naturalists' classificatory practices. This began to change in the 1830s with the emergence of the new experimental culture of organic or carbon chemistry. The pure stoichiometric substances produced, individuated, identified and classified in carbon chemistry were embedded in a web of new types of experiments and work on paper with chemical formulae that did not exist outside academic chemistry at the time. However, as material things these novel substances remained potential commodities—a potential that began to be realized

some twenty years later with the rise of the synthetic dye industry. There was no move away from perceptible, applicable substances and towards the study of imperceptible chemical composition or molecular structure in nineteenth-century chemistry. The significance of perceptible substances was not transformed into that of mere targets that allowed experimental investigations of molecular structure. Rather, substances remained chemists' predominant objects of inquiry well into the twentieth century, and studies of composition, constitution and molecular structure remained closely tied to studies of the perceptible and applicable dimension of these things.

Workshops and Edited Book Project

(*Ursula Klein* in Collaboration with *Emma Spary*, Department of History and Philosophy of Science, Cambridge): *The Making of Materials: Science and Technology in the Early Modern Period*

Emma Spary

This book project, which is based on two workshops that took place in December 2004 and August 2006, brings together the contributions of fourteen well-known scholars from a range of disciplines; they include historians of science and medicine, cultural historians, historians of technology and sociologists of science. Their essays deal with different aspects of the relations between the sciences and the arts and crafts in the production of material substances in the early modern period. Most, perhaps all, of the materials studied in the volume—among them metals, gunpowder, dyestuffs, milk, distilled liqueurs, timber, cosmetics, vegetable remedies—appear as unusually complex "thick things," which challenged the historical actors' collective skills and routine techniques, procured unforeseen effects, and often resisted expressed goals of production and established schemes of understanding. Gunpowder, for example, though apparently made from the same ingredients mixed together in standard ways, did not always produce the same phenomena. Likewise, the outcome of dyestuff production was uncertain and required ongoing quality control, while plant and animal materials such as balsams or milk resisted straightforward identification by eighteenth-century chemical analysts and pharmacists. The science of artisanal experts and the artistic agendas of savants, which investigated materials like these, demand scrutiny of historical actors' practices in the making of materials and their boundaries between practical and learned knowledge.

Given the widespread involvement of academically trained experts in manufacturing output and the involvement of some social groups of artisans in the publication of texts and drawings in the period between 1500 and 1800, the essays collected in our volume suggest that our application of the terms "arts and crafts" (later called "technology") and "natural sciences" must be reconsidered in writing the history of that period. Early modern learned polemics against unlettered, routine and machine-like artisans operating outside scientific institutions have all too often blinded historians to the relations between social space and forms of academic and practical expertise. Further problematizing the issue have been long-standing moral hierarchies among learned elites, which privileged public benefit over personal gain, and nineteenth-century scientistic hierarchies which privileged theory, abstraction and epistemic purity

over practice, materiality and the embeddedness of objects in intersecting learned, commercial, and everyday worlds. Such asymmetries continue to color our understandings of the relationship between learning and the arts and crafts, materiality and science, even when we are aware that forms of conceptual knowledge and bodily skills in transforming matter were distributed among social groups in many different ways. In the volume we seek to replace the extant polarization between craftsmen and philosophers in the early modern period with a finer-grained classification of makers and knowers. The studies assembled in the volume address a range of problems. They ask how forms of learned knowledge and bodily skills were involved in the making of materials such as gunpowder, liqueurs, or chemical remedies. They explore the interactions between governments, artisans and academicians in the production of materials, and consider the ways in which the social economy of conceptual knowledge and skills changed between the sixteenth and eighteenth centuries. They investigate the relations between the commodification of nature and materials in the eighteenth century, and the social, material and cognitive networks of scientific and artisanal practices. They show how the scientific expertise and social authority of different makers of materials were mediated by social place, access to print or patronage, wealth, conduct and self-fashioning. By exploring the relations between modes of production and consumption of materials, the essays throw new light on the ways in which changes in production, consumption and commodification affected scientific expertise or social authority over materials.

→ "Professional Knowledge of Practitioners" p. 23

Further Participants and Activities

Andrew Pickering was a visiting scholar of the group, contributing to the two workshops and the book project *The Making of Materials*.

Maria Rentetzi (post-doctoral fellow and visiting fellow in 2004 and 2005) contributed to the project with a comparative study on radium in the early twentieth century. Comparable to the substances in eighteenth-century chemistry, which were both commodities and scientific objects, radium was widely used in the early twentieth century: as an object of scientific inquiry in chemistry and physics, a source of radiation in medicine, and a component of food, cosmetics and other goods of daily consumption.

Leo Slater was a visiting scholar in the research group and in Department III, working on vaccines in the twentieth-century medical-industrial complex in the U.S.A.

Andrew Sparling contributed as predoctoral fellow to the project with a study on Johann Rudolf Glauber (1604–1670) and alchemical substances in the seventeenth century. Glauber sought to support himself by marketing substances such as *spiritus salis* (hydrochloric acid) and sal mirabile (later Glauber's salt, sodium sulphate), which became applied as chemical remedies from the late seventeenth century onward. At the same time he presented himself as a philosophical alchemist, and thus rhetorically demarcated himself from ordinary craftsmen, *Laboranten* (most of which were distillers), and merchants.

In collaboration with the *Collegium Johann Beckmann*, a working group in the German *Society for the History of Technology*, Ursula Klein organized a workshop entitled

"*Materia technologica*: Rohstoffe in historischer Perspektive," which took place at the *Deutsches Technikmuseum Berlin* in April 2006. A related book entitled *Materia Technologica*, edited by Ursula Klein and Torsten Meyer, will be published in the series *Cottbuser Studien zur Geschichte von Technik, Arbeit und Umwelt,* ed. Günther Bayerl, Münster: Waxmann.

Project 2

Technoscience *avant la lettre*

Ursula Klein, Dana Simmons

Dana Simmons

Historical studies of the making of materials in the early modern period lend themselves to another historiographical theme: the emergence and historical forms of technoscience. The systematic and stable interconnection of scientific and technological practices and institutions into a "technoscience" is usually considered as the outcome of developments in the twentieth century, with forerunners in the second half of the nineteenth century. In the time period before the late nineteenth century, so the predominant view, there may have been exchanges of knowledge, skill, and instruments between savants experimenting at academic institutions and manufacturing craftsmen and artisans, but this interaction did not result in a sustained interconnection of these two cultures. Traditional history of chemistry has adapted historical accounts of chemistry prior to the emergence of synthetic-dye industry in the second half of the nineteenth century to this predominant general view. Although it has been acknowledged that chemical technology occasionally stimulated developments in eighteenth-century academic chemistry, and vice versa, chemical science and technology prior to the late nineteenth century have largely been studied as two separate domains. By contrast, it is the central thesis of this project, based on previous historical studies, that chemical science and technology were strongly and systematically connected with each other long before the second half of the nineteenth century. The project aims to unravel these interconnections, with a focus on the eighteenth century.

After the first successful steps were taken in the seventeenth century to institutionalize chemistry in academies, medical faculties, botanical gardens, and museums (such as the Ashmolean Museum at Oxford), in the eighteenth century chemistry was an established part of the intellectual world. Eighteenth-century chemists were teachers and professors, authors of learned books and experimental reports, members of academies and scientific societies, and visitors of coffee shops and salons. Yet, they differed markedly from other savants of the time; not only because they spent many hours of the day experimenting in the laboratory, but also because of their diverse technological and commercial activities. Many of the eighteenth-century European

chemists were apothecaries, metallurgical officials and consultants, inspectors of manufactories, members of state committees and technological boards, and entrepreneurs. Eighteenth-century chemists working at medical faculties, professional schools and other academic institutions instructed their students about pharmaceutical techniques and various areas of practical, artisanal chemistry. In their laboratories they repeated artisanal operations and analyzed materials produced and applied in the chemical arts and crafts, in the first half of the eighteenth century using almost exclusively instruments shared with assayers, apothecaries and other artisans.

The interconnectedness of chemical science and technology in the eighteenth century did not merely depend on the existence of the hybrid persona of artisan-chemist, occupied with both scientific and technological activities. It was sustained in particular by a shared material culture that spanned from the academic laboratory to the chemical workshop, and comprised material objects of inquiry, instruments and vessels, reagents, techniques and the laboratory. Eighteenth-century chemists shared many of their instruments and vessels with assayers, apothecaries and other artisans. Their smelting and testing furnaces, bellows, crucibles, calcination dishes, and balances overlapped with the instruments used by assayers. The same types of mortars, pestles, filters, vessels, boxes, glass tubes, vials, retorts, alembics, pelicans, receivers, and transmission vessels that academic chemists used in their laboratories were also used in the laboratories of eighteenth-century apothecaries for the making of medicines. There was even correspondance of the size of vessels and instruments used by academic chemists, apothecaries, assayers and distillers. The small-scale trial was intrinsic to assaying, which studied the composition of ores and other minerals to calculate the productiveness of mining and metallurgy. As pharmacy was still a handicraft in the eighteenth century, it also produced remedies on a small scale and for a comparatively small community of local consumers. The distilling of essential oils for the making of perfumes and alcoholic spirits was performed on a small scale too, even though there was enormous modification of distilling apparatus used by commercial distillers.

Unlike the core areas of eighteenth-century experimental philosophy that became transformed into "experimental physics" in the course of the nineteenth century, chemistry was a culture that established specific sites for experimentation and manufacture, the "laboratories." In the eighteenth century the term "laboratory" referred almost exclusively to distinct rooms where chemical operations (from the point of view of the historical actors) were performed. The Latin word *laborare*, from which "laboratory" is derived and which designated manual work, points to the similarity of these places with workshops. In the eighteenth century "laboratories" were both rooms for experimenting at academic institutions and for chemical manufacture and control in the apothecary trade, assayer's shops, arsenals, and distilleries. By contrast, in the core areas of experimental philosophy, "physical cabinets" and "physical theaters" were established. As is almost manifest in these latter terms, these institutions served as locations for the collection and exhibition of instruments and for the demonstration of curious experimental effects, rather than as actual places of daily experimental work.

The overlap of the material equipment of eighteenth-century academic chemical laboratories with artisanal laboratories accorded with the fact that academic chemists shared most of their experimental techniques with apothecaries, assayers and

distillers. Dissolutions, distillations, evaporations, precipitations, combustions and smelting were types of operations performed by both academic chemists and artisans. As many of the material substances studied in academic chemists's laboratories were bought from merchants and applied in practice by apothecaries and other artisans, the agreement between the material culture of chemical science and chemical technology was quite strong. Work and publications on this theme by Ursula Klein

Chemical-pharmaceutical instruments, 17th–19th century (courtesy of the Apothekermuseum, Basel)

Chemical-pharmaceutical instruments, 17th–19th century (courtesy of the Deutsches Apothekermuseum, Heidelberg)

focused on eighteenth-century chemistry, the hybrid persona of the eighteenth-century chemist-artisan (or chemist-technologist) and the shared material culture of chemical science and chemical arts (or chemical technology). See, in particular, Ursula Klein, ed. "Technoscientific Productivity," special issues of *Perspectives on Science* 13 (2005) 2 and 3.

For the work of Dana Simmons who was a postdoctoral fellow both in the Department III and in this Research group, see page 122.

Project 3

Historical Styles of Experimentation and Observation: *Historia experimentalis*

Ursula Klein

→ "History and Epistemology of Experimentation" p. 90

Historical studies of materials in the early modern period also shed new light on another prominent theme in the historiography of science: the history of experimentation and observation. Questioning the common view that "experimental philosophy" was the only style of experimentation in the early modern period, they contribute to a historicization of our concept of experimentation.

From the late seventeenth century until the early nineteenth century, "experimental history" (*historia experimentalis*) was a collective style of experimentation in addition to "experimental philosophy." The "experimental history" institutionalized during the seventeenth century was a tradition of experimentation and observation that evolved around the multiplicity of natural and artificial things. Like natural history, experimental history collected, described and ordered facts relating to the perceptible dimension of a great number of different objects. But whereas natural history was concerned with the observation and collection of things "given by nature," experimental history reported phenomena procured by intervention into nature, both in the arts and crafts and academic laboratories. For example, late seventeenth-century and eighteenth-century chemists' experimental histories of substances reported phenomena observed at many different places, ranging from households and everyday life to the fields, the workshop and the academic laboratory. Their experimental histories of substances ended with the collection and classification of phenomena, leaving inquiries into their causes to "experimental philosophy."

An explicit program of an "experimental history" first arose in the early seventeenth century when Francis Bacon (1561–1626) became its most prominent spokesman. Bacon outlined his ideas of an experimental history (*historia experimentalis*) in a text entitled *Preparative towards a natural and experimental history*, which was published in 1620 in the same volume with the *Novum Organo*n. Experimental history in Bacon's original sense was, first of all, a collection and description of existing factual knowledge developed in the arts and crafts. It was an inventory of artisanal operations and experiments in the broadest sense, which complemented natural history. Robert Boyle (1627–1691), a keen follower of Bacon, also argued that learned men must collect as many facts as possible from craftsmen and merchants. Robert Boyle, in particular, made efforts to demarcate experimental history from its philosophical counterpart, that is, experimental philosophy. For example, in his *Experimental History of Colours* (1664), he asserted that his present work will excite its readers by the delivery of matters of facts, free from any speculation and explanation. He further added remarks about the method and the literary style of experimental history, which served to demarcate it further from experimental philosophy. Experimental history

did not require a structured presentation of facts. If the experimenter was not, or not yet, able to create order among the experimental facts and to discover regularities, he could present them as they came to mind and hand, that is, by "declining a methodical way." Furthermore, as experimental history in its most rudimentary stage was a mere collection of phenomena engendered by operations or experiments, the extension of experiments required the greatest "liberty" of action, that is, the experimenter was allowed to add new experiments and thereby collect new facts without knowing where the journey would go. Unlike experimental philosophy, experimental history abstained from reduction, conceptual unity, and inquiry into hidden movements and causes.

Boyle's emphasis on the absence of any speculation and preconceived methods in experimental history, his insistence on the collection of phenomena without any intellectual and methodical constraints, resonated with a broad cultural movement: the *historia* tradition. The *historia* tradition had gained momentum in the Renaissance, when physicians and other learned men revalued the empirical description of objects of nature and of human action vis à vis speculation about causes. As Pomata and Siraisi pointed out recently, "*historia*" offered thorough descriptions of "how things are" without explaining why it was so. It sought to base knowledge on sense perception and aimed at knowledge of particulars without forming an overarching conceptual umbrella. Furthermore, Bacon's and Boyle's insistence on the importance of technical artifacts and artisanal "experiments" for the writing of an experimental history was embedded in another ongoing cultural movement, which revalued the role played by the methods and accomplishments of artisans for the acquisition of natural knowledge. The technological treatises of the fifteenth and sixteenth centuries on architecture, machines, shipbuilding and navigation, military instruments and ballistics, the art of fortification, mining and metallurgy, alchemy, the art of distillation and so on gave voice to this new attitude, which questioned the Scholastic divide between manual labor and theory, nature and art, certain knowledge (*episteme*) and technology (*techne*). Both the *historia* tradition and Baconian experimentalism stabilized experimental history as a collective style of experimentation and contributed to its institutionalization as an acknowledged academic practice.

→ "History of Scientific Observation" p. 49
→ "History in Early Modern Europe" p. 50, which concentrated on activities in the historia tradition other than historia experimentalis

Early modern assaying laboratory (courtesy of the Deutsches Museum München)

17th-century officine and laboratory. From B. Schnurr, Vollständiges Kunst-, Haus- und Wunder-Buch. Frankfurt: 1676

Historians of science have discussed Bacon's program of an experimental history mainly in connection with the Royal Society's endeavor of a "history of trades" in the seventeenth century. But this program also had an impact on the encyclopedic ventures of the *Académie Royale des Sciences,* such as the large seventeenth-century project on the history of plants, which also included chemical experiments; *the Descriptions des arts et métiers*; and the more successful *Encyclopédie ou dictionnaire raisonné des sciences, des arts et métiers* by Denis Diderot and Jean D'Alembert (1751–1780); as well as on the plan of the Berlin Society of Sciences between 1718 and 1720 to put together a *Theatrum Machinarum Universitatis*, that is, a precise description of all machines that exist in the world along with depictions. Moreover, the Baconian program of an experimental history also lent intellectual authority to a distinct style of academic experimentation, different from "experimental philosophy," which continued well into the nineteenth century. This latter significance of "experimental history" for an adequate historical understanding of the institutionalization and development of the experimental sciences from the early modern period until the early nineteenth centuries has been ignored almost completely in the existing historical literature.

The distinct style of experimental history can be discerned especially well in the history of chemistry from the late seventeenth century to the early nineteenth century. In the chemistry of this period, "experimental history" meant a collection of phenomena or facts about a great number of particular substances from all possible practical areas, ranging from artisanal sites and everyday life to the academic chemical laboratory. Chemical experimental history was concerned with ways of preparing substances, the perceptible properties of substances, that is, their color, smell, taste, consistency, measurable physical properties, and chemical properties and their practical uses. It meant an extension of objectives of natural history to a laboratory science, which, like the classical domains of natural history—botany, zoology and mineralogy—was concerned with a great multiplicity of things. Its objects of inquiry were not hidden causes and imperceptible entities (such as atoms, forces, the vacuum, electrical fluids and other typical philosophical objects of "experimental philosophy"), but the perceptible dimension of materials and operations. And its goal was not philosophical knowledge, but connoisseurship of materials, their varieties, properties, ways of chemical transformations, and practical uses. Well into the nineteenth century, chemists often performed experiments on a broad variety of different substances, knowing that they would not, or not yet, be able to unravel regularities and general chemical laws, or to improve chemical theories. One day they would study a mineral water from a nearby spring, the next day an iron ore from a new ore deposit, then test the quality of a dyestuff produced in a local manufactory, distill rosemary to reproduce the essential oil of rosemary sold in apothecary's shops, and afterwards study the chemical properties of apothecaries' ordinary ether and compare it with ethers prepared in slightly different ways in their laboratories. Their experi-

ments turned from the study of a material belonging to one class to that of another class, and from the kingdom of minerals to vegetable and to animal substances, and vice versa. Compared to experimental philosophy in the seventeenth and eighteenth centuries, and compared also to the comparatively coherent "experimental systems" in the twentieth-century laboratory sciences, which evolve around one, or one system of, scientific objects and cluster of questions, this style of experimentation may at first glance appear as aimless artisanal tinkering or mere cookery. As it contributes little to heroic historiography, historians of chemistry, too, have obliterated it from systematic historical research. Instead, most historians of chemistry have highlighted episodes of eighteenth-century chemical experimentation in which experiments were more systematically focused on one scientific object and interconnected to a coherent "investigative pathway" (F. L. Holmes). However, the scientific careers of the vast majority of chemists from the seventeenth century until the first decades of the nineteenth century show that, as a rule, chemists' experiments studied a great number of different substances, and often changed from one substance to the other without organizing their experiments into a systematic investigative pathway, directed either "by nature" or conceptual concerns.

Another characteristic feature of the experimental history in eighteenth-century chemistry was the frequent repetition and extension of experiments performed with one particular substance, and the continuous accumulation of factual knowledge about the ways of its preparation, its perceptible properties and practical uses. In the course of the eighteenth century it was especially the testing of chemical properties—such as combustibility, acidity, solubility in various solvents, interaction with reagents—that contributed to the extension and refinement of the experimental histories of substances. "Chemical property" referred to the observable phenomena that were created when a substance was heated or mixed with a reagent. Experimental histories reported such phenomena without seeking to explain them by referring to invisible movements of substance components and chemical affinities. In the second half of the eighteenth century chemists' testing of the chemical properties of substances with a growing number of solvents and reagents led to an enormous increase in the size of experimental histories, sometimes covering dozens of pages for one single substance. At the same time chemists addressed a broader and more diverse audience than in the early eighteenth century, when physicians, students of medicine and pharmaceutical apprentices constituted the majority of practitioners interested in chemistry. New groups of practical men interested in learning chemistry, such as dyers, manufacturers and officials of the state bureaucracy, demanded detailed descriptions and analyses of multifarious artisanal techniques. This development contributed to changes in the presentation of experimental histories, especially in chemical textbooks, in the last decades of the eighteenth century. Chemists then often presented experimental histories of substances in a style of disinterested collection of facts that was disconnected from the practical uses and techniques in the chemical arts. This move was reinforced by the separation of eighteenth-century chemical textbooks into parts on "pure chemistry" and "applied chemistry," with the inclusion of the histories of substances in the part on "pure chemistry" and the descriptions of artisanal techniques and practical uses of materials in the part on "applied chemistry." Nevertheless, the observation, repetition and modification of artisanal operations in

the academic chemical laboratory remained an important source for chemists' experimental histories of substances well into the nineteenth century, as can be seen much better in experimental reports than in chemical textbooks. Likewise, observations on visits to mines, foundries, assaying shops, mints, distilleries, dyeing manufactories, workshops of glass makers, chemical factories and so on were a persistent source not only for texts on "applied chemistry" but also for chemists' experimental histories of substances. Furthermore chemists in both the early and late eighteenth century gathered facts for the writing and teaching of experimental history in their own artisanal occupations as apothecaries, mining officials, inspectors of dyeing, porcelain makers, manufacturers of beet sugar and other kinds of chemical entrepreneurship. Eighteenth-century chemists' dual careers as savants and technologists contributed considerably to their experiential knowledge and to the enrichment of their experimental histories.

Two publications on this theme appeared in 2003 and 2005: Ursula Klein. "Experimental History and Herman Boerhaave's Chemistry of Plants." *Studies in History and Philosophy of Biological and Biomedical Sciences* 34 (2003): 533–567. Ursula Klein. "Experiments at the Intersection of Experimental History, Technological Inquiry, and Conceptually Driven Analysis: A Case Study from Early Nineteenth-Century France." *Perspectives on Science* 13 (2005) 1: 1–48.

Project 4

Paper Tools

Ursula Klein

In continuation of two earlier book projects (Ursula Klein, ed. *Tools and Modes of Representation in the Laboratory Sciences.* Dordrecht: Kluwer, 2001; Ursula Klein. *Experiments, Models, Paper Tools: Cultures of Organic Chemistry in the Nineteenth Century.* Stanford: Stanford University Press, 2003) Ursula Klein has further studied the role played by paper tools (chemical formulae) in the experimental practice and concept formation of nineteenth-century chemistry. These studies have been part of a collaborative, cross-disciplinary project of the Hermann von Helmholtz-Zentrum für Kulturtechnik (Humboldt-Universität zu Berlin) on the productive function of sign systems in science, technology, and art.

Inspection of the paddle wheel after the breakdown of the experimental performance.
Photo: Norbert Gerdes, Oldenburg

Independent Research Group II

Experimental History of Science

Director: *H. Otto Sibum*

From the beginning, the objective of the independent research group has been to investigate the *texture of scientific change*. In the last decade historians of science have shifted their attention to look beyond familiar printed sources. Wanting to understand what scientists *did* and not merely what they wrote, historians have drawn their readers attention to the silent representatives of the past in order to understand the hands-on processes by which science is made: instruments, laboratory architecture, personal diaries, lab- and field notebooks, and collections of strange objects. In this endeavor the research group focused especially on the knowing body of the scientist, by combining historical scholarship with the re-working of experimental practice. In particular, embodied knowledge was explored, that is, the historical and epistemological meanings of the experiencing subject in physical investigations of nature. Previous generations of historians had emphasized that remarkable achievements in science were often based on a semi-mystical "tacit" or "personal" knowledge. We were however able to show that this tacit knowledge can usefully be conceptualized as embodied knowledge, a form of knowledge that can be reconstructed by looking at the intersection of actions and structures in specific fields of cultural production.

Hence we have taken up the challenge represented by the long-standing divide between epistemology and practice, and sought to break with traditional concepts of disembodied knowledge. At the heart of this conception of embodied knowledge lies the unity of experience of the actors involved in productive work. Knowledge governs but does not determine practice; and practices, as they are enacted, may constitute a source of new information and open prior knowledge to reproduction or transformation—with implications for subsequent practices. Hence this is not merely about shifting historians' interest from the 'software' of science to its 'hardware;' we have attempted to go beyond the time-honored divide between 'thinking' and 'doing'—a dichotomy often reproduced in the very process of being questioned—by putting forward a conceptualization of practices as 'knowledge in action.' Experimental as well as theoretical techniques are hence to be understood as human performances of specialized work involved in generating knowledge.

Within this conceptual framework, members of the group have pursued research projects covering two important historical periods of cultural and scientific change. The first one explores hitherto unrecognized practical knowledge traditions and their impact on the formation of science during the mid-18th until the mid-19th century. The second focuses on the changing experiential basis of science in the period between 1870 and 1920. The project leader H. Otto Sibum has finished his long-term project on experimental thermodynamics and the embodiment of knowledge in the age of precision. Together with David Aubin and Charlotte Bigg he also completed a research project on observatories and observatory techniques in the nineteenth century (D. Aubin, C. Bigg, H. O. Sibum (eds.) *The Heavens on Earth. Observatory Techniques in the Nineteenth Century*, forthcoming with Duke University Press. The current members of the research group are pursuing the following research projects.

→ "History of Scientific Observation" p. 49

Project

Working Knowledge and Science 1780–1870

This project aims at investigating an historical period in which modern science was coming into existence, a period critical for the investigation of the fruitful and reciprocal interactions between science and other forms of knowledge. It spans the mid 18th until the mid 19th century—a time of major cultural transformations. It is the age of Enlightenment with its ideal of promoting "useful knowledge." As historians have come to realize the close ties between epistemology and praxis, so too their terminology for this time has come under question. Economic historians who once spoke of the industrial revolution can now be heard referring to the "Industrial Enlightenment." Historians of science, once comfortable with the "second scientific revolution" (understood as the quantification of the Baconian sciences) followed by the conception of the rise of "a quantifying spirit" now stress the importance of the geographical dimension of knowledge creation in the Enlightenment period.

What does it mean to work in a scientific workplace, to labor in a scientific laboratory? What kind of knowledge is situated in these specialized performances of work? These are the questions at the heart of the project. They are questions that take on new meaning in the period just discussed. Originally the terms episteme, scientia, scienza, science, Wissenschaft meant knowledge or skill in general. It is only over time that they became specialized terms to denote a more certain and authoritative form of knowledge than "ordinary knowledge." Moreover this linguistic divide is often mirrored by a social distinction between those who work with their heads and those who work with their hands. It even contributed to a cultural distinction between West European lands (and former colonies) that have modern science and those that do not. Most recent historical scholarship emphasizing the geographical dimension of Enlightenment science has already started to provide several case studies that open these workshops of knowledge creation.

At its broadest, this project studies the changing character and status of work in this process of the formation of the exact sciences in the century after 1750, emphasizing the changing forms of intellectual work in relation to physical labor. In this way, the field, the workshop, the cabinet, the laboratory can all be studied as sites of "knowledgeable labor." On this basis we seek to reconstitute past practitioners' knowledge of different kinds of experimental work regardless of disciplinary boundaries. Furthermore a detailed reconstruction of practices of exchange between these individuals and collectives provides further insights into a hitherto unknown web of practitioners' knowledge. The large-scale mapping of such knowledge traditions and their interactions allows us to study in detail the historical and epistemological conditions of the emergence of scientific knowledge in this period. To this project several researchers are contributing.

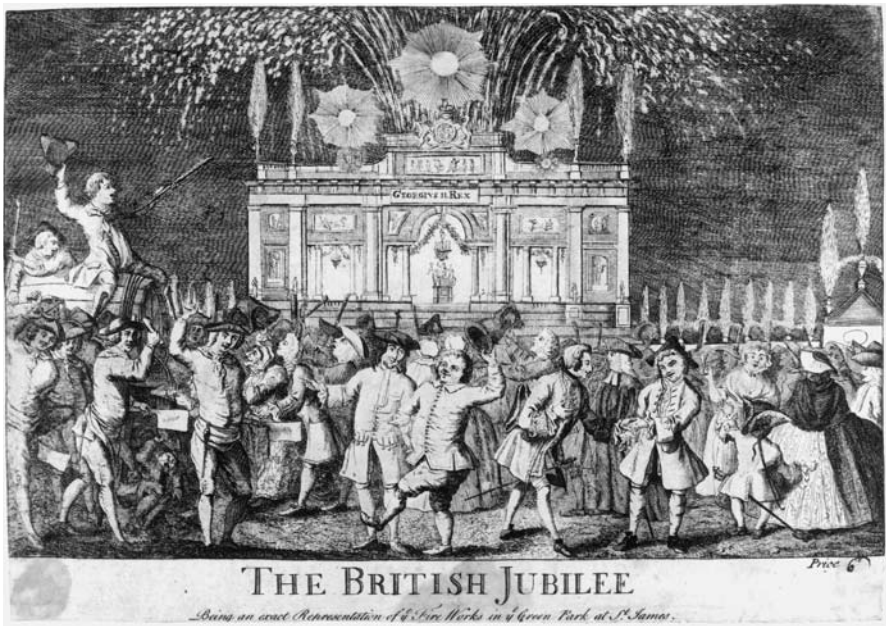
→ "Professional Knowledge of Practitioners" p. 23

Anna Märker

Anna Märker (Postdoctoral Fellow, Cornell University, U.S.A.) joined the group in 2005 with a project on the notion of "useful knowledge" and the emergence of modern science, 1750–1850. The aim of the project is to investigate conceptual changes concerning the notion of utility in science around 1800 in order to illuminate how these changes were part of the development of modern scientific practice and its cultural, institutional and social context. At the current stage, the project is based on two case studies located in the eighteenth and early nineteenth century. The first case study is an analysis of Kant's *Natural History and Theory of the Heavens* in the context of contemporary natural historical approaches; it is used to analyze the relationship between natural philosophy and natural history with regard to the concept of utility. A second case study concerns the transfer of the production of anatomical models from Florence to Napoleonic France in the context of institutional and conceptual changes regarding the role of natural science for the state. The studies address questions such as: What is the (implicit or explicit) understanding of utility that underlies a particular claim to the usefulness of natural knowledge? Which actors assert, or contest, such claims? For whom is knowledge about nature considered to be useful, and in what way? What is the mutual influence between this notion of utility, scientific institutions and knowledge-making practices? How do changing concepts of utility thus relate to the emergence of new regimes of knowledge production?

Simon Werrett

Simon Werrett (Visiting Scholar, Washington University, Seattle, U.S.A.) continued research on his project, Fireworks and Natural Philosophy in Early Modern Europe, exploring the history of changing interactions and definitions of art and science seen from the perspective of the history of pyrotechny and its evolving relationship with the sciences in early modern Europe. Taking a comparative perspective in several national contexts, primarily England, France, and Russia, Werrett traces the history of the art of making and performing fireworks for war and display from the late fifteenth century to the era of Europe's Napoleonic wars, when fireworks were transformed



The British Jubilee: Being an exact Representation of ye Fire Works in ye Green Park at St. James (London, 1749) engraving. Anonymous, A collection of cuttings from newspapers, advertisements, playbills, etc., formed by Fillinham. Bound in eight volumes (c. 1700–1860), Vol. 5, f. 47v. The British Library, London

into commercial spectacles similar to those still witnessed today. In the interim, fireworks occupied an intriguingly ambiguous and shifting position in classifications of knowledge and practice, whereby a great variety of opinions and activities identified and allied pyrotechny with different arts and sciences. Werrett's research, which he expects to appear as a monograph in 2007–08, traces these different positions and relates them to the social, cultural, and historical contexts within which fireworks were performed, examining contests among groups including gunners, mathematicians, men of letters, natural philosophers, architects and poets, as they sought to define the nature of pyrotechny and claim authority over fireworks performances. By following the history of fireworks, Werrett addresses a long-standing theme in the history of science, concerning the debts of early modern science to the skills and practices of artisanry, traditionally a question explored in relation to the 'Scientific Revolution' of the 16th and 17th centuries. The case of pyrotechny, examined here over a longer period and in several different locations, demonstrates the complexity, contestedness, and enduring interactivity of artisanry and science, a reciprocal relationship not restricted to the Scientific Revolution, but one continuing and evolving into the nineteenth century. By recovering the pyrotechnician's skills and practical knowledge, Werrett shows the many ways fireworks offered resources for transformations in natural knowledge-making, and how in turn the sciences shaped the history of pyrotechnics in a great variety of ways over several centuries. These interactions, contests, transfers and alliances are set in historical context, and offer fresh insight into the shape and meaning of science as it related to the arts in early modern Europe.

Annik Pietsch

Annik Pietsch (Research Scholar) is continuing her investigations on innovations in painting techniques in Germany 1750–1850 with the aim to solve a puzzle well-known amongst art historians and conservation scientists: despite the improvement of scientific knowledge about light, color and matter in the 1800s, the period saw little by little the disappearance of well-established painting practices, a process historical usually referred to as the "Verfall der Malerkunst" (degeneration of the art of painting). Contrary to the common understanding that this degeneration took shape because of a lack of quality in materials and techniques, or a lack of artistic quality according to aesthetic criteria, Pietsch argues that painting techniques are part of a much broader transformation occurring in a complex network of diverging knowledge traditions concerned with light and color. Her analysis of this process is based on a careful investigation of individual works of art as manufactured objects. Painting techniques serve here as a nexus where scientific, philosophical, aesthetic and technical discourses intersect; and where practices, concepts and materials of the different knowledge networks are exchanged. This study concentrates on developments between 1750 and 1850 in the Prussian capital, Berlin, with

"Bildnis des Philosophen Hegel, 1831 gemalt von Prof. Jak. Schlesinger, Generalrestaurator der königl. Museen zu Berlin". Staatliche Museen zu Berlin

a focus on the events around 1820-1830. Three characteristic paintings were chosen: *Die Erfindung der Malere*i by Eduard Daege (1805–1883), *Bildnis des Philosophen Hegel* by Jakob Schlesinger (1792–1855) and *Die Schlucht bei Amalfi* by Carl Blechen (1798–1840). These three paintings, each belonging to a different type of painting genre (history, portrait and landscape painting), were all produced around 1830 by painters of the same generation. Each is an exemplar of one of the main painting techniques of the time and thus can serve as a key starting point to describe the broader historical development of these specific technologies.

Larry Stewart (Visiting Scholar, University of Saskatchewan, Canada) is engaged in research into the development of sites of experimentation during the early industrial revolution. His focus has been on chemists and their laboratories, from private sites in country homes, to commercial enterprises associated with manufacturing, such as those of James Watt and Josiah Wedgwood, to academic laboratories, and including the experimental efforts of small philosophical societies. Much of the research involves the international trade in instruments including Italy, France and the Netherlands as well as Britain between 1760 and 1820. This work has led to a collaboration with the University of Saskatchewan, Canada.

M. Norton Wise

M. Norton Wise (Visiting Scholar, University of California at Los Angeles, U.S.A.) continued his work on the book project on bourgeois Berlin and laboratory science. Laboratory science, in the modern sense of laboratory teaching and research carried on at universities, only came into existence in the first half of the 19th century. The development occurred in all European countries but with quite different historical trajectories. This book takes up the issue for Prussia: How did laboratories enter the universities, and especially the University of Berlin, where they had been excluded under the neo-humanist vision of higher learning, which separated the pursuit of the ideal from that of the real, or the Humboldtian nurturing of the mind from material interests? It seeks its answers rather broadly, in the historical dynamics of the industrializing military state of Prussia and the middle-class citizens who saw themselves and their capacities as the motors of the future.

What classical languages were to the Gymnasia and Universities, mathematics and science were to a variety of new schools established to modernize the military (Kriegsschule and Vereinigte Artillerie- und Ingenieurschule) and to promote modern industry and civil engineering (Gewerbeinstitut and Bauschule). Teaching laboratories first appeared in these state-supported institutions. One crucial feature of their organization was that they drew many of their teachers of mathematics and science from among young university faculty, and it was these same people who carried the interests of the technical schools back into their university teaching. Especially notable for this book are the teachers—Magnus, Dove, Mitscherlich, Dirichlet—of the circle of ambitious young men who founded the Physikalische Gesellschaft zu Berlin in 1845, including Emil du Bois-Reymond, Werner Siemens, and Hermann Helmholtz. This group provides the concrete basis for exploring the rich interaction of artistic interests, classical values, mathematical methods, and precision instruments that shaped

the science that came to be called modern. It was a science that emerged at the crossroads of intellectual and technological culture and it is just this cultural crossroads that the book seeks to illuminate.

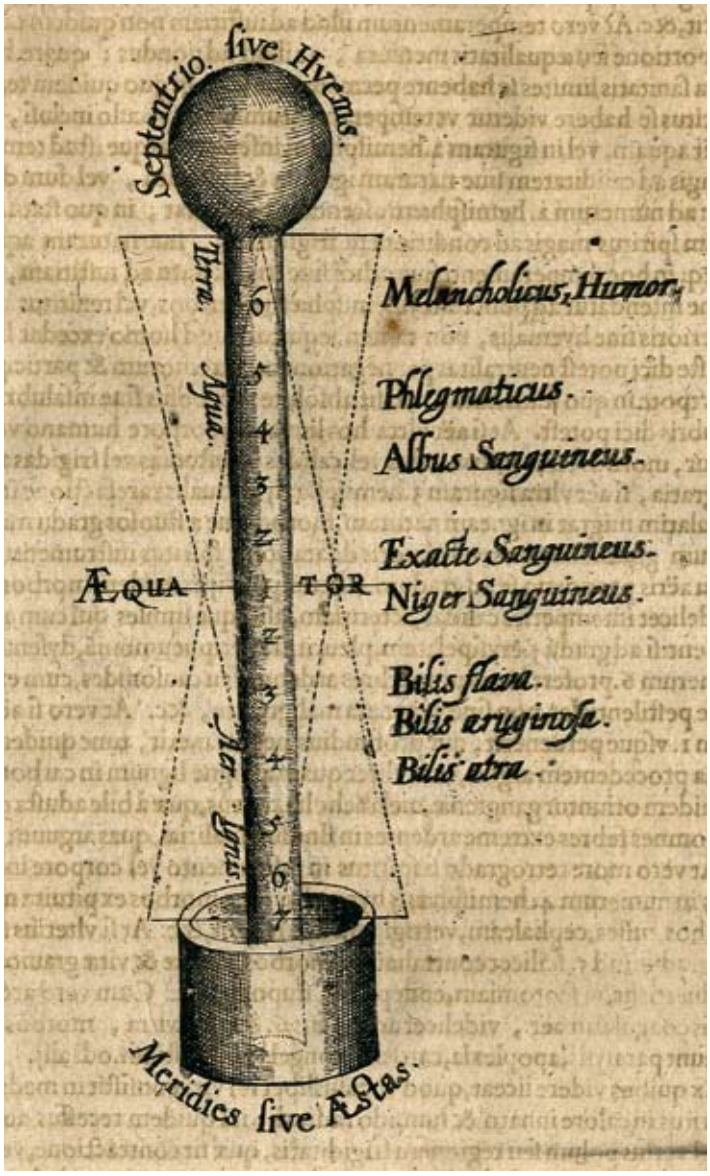

Frédéric Graber

Frédéric Graber (Postdoctoral Fellow, Centre Alexandre Koyré, France) investigates leveling practices in 18th and 19th century France and Germany. At the turn of the 19th century a new hope emerged for some French engineers that large scale field-data gathering would help shift one of the most typical activities of engineering from the field into the cabinet: leveling, the measure of the difference of level between two points. There was a diversity of leveling practices. Leveling was used by very different kinds of people, ranging from specialized engineers, who understood leveling as a high-precision measurement and gave it a central place (both technically and socially) in their project-making activities, to completely unskilled users, mostly interested in draining or diverting water for agricultural or industrial purposes. Leveling was also used by surveyors or topographers as one tool for establishing the altitude of given points in the landscape: these practitioners did not usually seek (at least until 1830) the same degree of precision as that required by civil engineers, wanting instead to give a global account of the relief, using techniques such as the naked eye or hypsometry. (Some scientists around 1800, dealing mainly with natural history, like Humboldt or Ramond, had a similar approach to heights, seeking to relate the presence of minerals or plants to a given geographic situation.) The surveyors adopted a global approach but only measured the altitude of a very small number of points they deemed significant, while the civil engineers' approach was very local (they usually measured only a strip of land) but with a great number of very close points (between 50 and 200 meters, compared to usually several kilometers for topographers.) The dream of a global knowledge of leveling was, in a way, a coming together of these two traditions. General-leveling were interesting both for topographers (especially military topographers) and civil-engineers, but these two groups had completely diverging expectations of what was relevant data and appropriate precision. Such large scale leveling could only be undertaken by state institutions, and studying the first attempts at launching such projects after 1800 is revealing of the conceptions of the competing groups of state engineers involved. Only a few, medium-sized, projects were carried out before the second half of the 19th century. By 1860, general-leveling was considered as an essential task for most European nations.

The aim of this project, transformations of decision-making tools, is to understand and place this hope in a more general picture of the transformations of leveling techniques between 1750 and 1870 (when all European countries launched their respective national projects of general-leveling), and especially in a general transformation in public works decision-making circa 1800, and the emergence of new requirements, such as explicit alternatives and comparisons.

Arianna Borrelli

Arianna Borrelli (Postdoctoral Fellow) has begun a project on heat and cold in observation and explanation in early modern and modern times. Ever since antiquity, heat and cold have been used both as descriptive and as explanatory concepts for a very large—at times unlimited—range of phenomena. Today as in the past, both stand very close to everyday experience, yet only one of them, heat, has found entry into modern science. Probing the history of heat and cold offers a possibility of investigating practices of experimenting and theorizing before they either became confined to their present roles as components of modern science or were completely excluded from it. At present, the investigation concentrates on two areas of interest, both concerning the boundary between observation and description and its role in defining phenomena and their explanations. One focuses on the early modern period, broadly circumscribed as the weatherglass and its observers in early seventeenth-century Europe. The second project concentrates on thermometer readings and equilibrium around 1800. By then thermometers had become an important tool for investigating the nature of heat, and thermometrical readings had emerged explicitly as a key factor in defining thermal equilibrium between physical systems. Joseph Black is usually considered the first to have underscored this connection. Around the same time, Johann Heinrich Lambert proposed to regard thermometers as measuring the force of heat which caused systems to reach equilibrium. One aim of this project is to collect and analyze the various viewpoints on this subject expressed by natural philosophers and craftsmen in the last decades of the 18th century and beyond, i. e. before the formulation of the second law of thermodynamics and the definition of absolute temperature based on it.



Robert Fludd, Integrum morborum mysterium: sive medicinae catholicae tomi primi tractatus secundus ... (Frankfurt: Wolfgang Hofmann, 1631), p. 53. The scale of the weatherglass is here related to the four elements (left) and to the five humors characterizing man's temperament (right). Image reproduced from: UB der HU zu Berlin; Robert Fludd, Integrum morborum mysterium: sive medicinae catholicae tomi primi tractatus secundus (Frankfurt, 1631); Med Nat 35; p. 53.

John Tresch (Visiting Scholar, Chicago University, U.S.A.) worked on the relationship between humans, technology and nature in the early machine age. His book project *Mechanical Romanticism: Techniques of Transformation in French Science and Culture, 1815–1851* examines reactions to the new machines of the Industrial Revolution and their impact on understandings of nature and society. The interrelations among various fluids and forces harnessed by new technologies (light, heat, steam, electricity, magnetism, spiritual power) suggested a dynamic and protean cosmos susceptible in many ways to human modification; research into these fluids and forces often involved an image of science in which investigator's moral aesthetics, and political qualities were engaged. Further, the discourses surrounding these entities were often characterized by uncanny mixtures of the organic and the mechanical. The project shows how the definitive sciences and technologies of the start of "the machine age" implied rather different relations between humans, technology, and nature than our current categories might lead us to expect.

Project

Science and the Changing Senses of Reality Circa 1900

The turn of the twentieth century is usually described as a crucial moment in the history of the physical sciences. One especially striking issue is the increasing number of techniques for investigating microphysical objects including x-rays, electrons, atoms, ions, molecules, and bacteria. Sophisticated instruments and apparatus were often described as extensions of the human senses and opened novel experiential spaces for scientists. These rare scientific experiences also challenged theory, putting new demands on those seeking to unify science. They induced among scientists an increasing reflexivity about their tools and methods and reshaped their sense of reality.

→ "Reorganizing Knowledge in Developed Science" p. 28

In this new world of scientific experience, physical scientists were confronted anew with an old debate concerning the relation between knowing and doing, and theory and experiment, which had accompanied the empirical sciences since their beginnings. According to the theoretical physicist Felix Auerbach, the various techniques applied by physicists to make the invisible visible were no longer mere practices of observation (such as those used in botany, astronomy etc): modern physics was, methodologically speaking, an engineering activity. "X-rays were not discovered by Röntgen," he concluded, "but in the first place invented in his laboratory." In the early 20th century the term invention became an apt description of the working techniques applied in the modern physical sciences. But it equally mattered in mathematics, engineering and the arts. Hence this project focuses on a number of such techniques

and their interrelations to understand how they changed scientists' practice and their sense of reality. Further we investigate the role played by this change of experiential space in the reflexive turn in the sciences, formulated in the early writings of Ludwik Fleck, Michael Polanyi, and Gaston Bachelard.

Several fellows contributed to this research project within the research group or as participants in an international conference convened by the research director in November 2004.

Charlotte Bigg

Charlotte Bigg (Research Scholar) is investigating "Brownian Motion and Microphysical reality circa 1900". The irruption of new microscales on scientific research agendas arguably contributed to a profound transformation in scientific practices and social organization in the early twentieth century. The case for this argument will be made for the physical sciences on the basis of a study of Brownian motion research in the 1900s. She investigates the investigations carried out by a handful of physicists and chemists in these years, most notably Jean Perrin.

Brownian motion, the perpetual and irregular motion of particles suspended in a solution, had long been known but until then little noticed. In the 1900s it came to encapsulate the fundamental issues at stake in early-twentieth century physical sciences: the nature and structure of matter, the relationship between statistical mechanics, kinetic theory and thermodynamics, and more broadly the validity of hypotheses and mechanical models in science.

Microphotograph of the height distribution of resin granules suspended in water. Brownian motion is responsible for the statistical stability of this distribution, which is comparable to the height distribution of gaz molecules in the atmosphere. This photograph was exhibited in the museum Jean Perrin helped create, the Palais de la Découverte, in the section dedicated to his own researches on Brownian motion. Phototèque Palais de la Découverte

Specifically, she examines how Perrin and Einstein deployed theory and experiment to produce for the first time 'visual' evidence of the existence of atoms and of the statistical nature of the second law of thermodynamics, e. g. how they developed methods to make sense of the behavior of floating submicroscopic particles and connect it with broader issues in the physical sciences. Close attention is paid to scientists' intricate interweaving of chemical and physical theories to account for the individual and collective behavior of particles, the significance of his application of Boltzmann's statistical mechanics for this purpose, and its implications for assessing the commensurability of the macro- and microscopic dimensions and for the development of thermodynamics. She investigates how the Brownian motion of submicroscopic particles was experimentally turned into 'visual' evidence of atoms, most notably through the use of the ultramicroscope, a new instrument enabling the visualization of particles below theoretical resolution (though not of atoms). And how Perrin in particular worked to make the molecular dimension intelligible by extending the domain of application of different theories into the molecular or macroscopic realms (e. g. extension of the kinetic theory of gases to suspended particles). In this respect, a comparison may be made with the simultaneous discovery of the syphilis bacillus using the ultramicroscope, and how microbiologists negotiated similar issues of scale shifting. Through a close analysis of the relatively circumscribed field of Brownian motion research, the momentous scientific, disciplinary and social stakes at play in this period and the profound transformation of the physical sciences are investigated.

David Aubin

David Aubin (Visiting Scholar, Université Pierre et Marie Curie, Paris, France) investigates Bénard Cells and Self-Organization. Henri Bénard was a French physicist who performed experiments on fluids for a Collège de France physics course given by Marcel Brillouin at the turn of the century. Bénard was among the first to study the behavior of a thin layer of liquid, about a millimeter in depth, when heated from below, the upper surface being in contact with air at a lower temperature. Experimenting with liquids of different viscosity, he observed in all cases the formation of a striking pattern of hexagonal cells. In 1916, Lord Rayleigh provided a mathematical explanation for the onset of instability in such a convective system. In his 1900 article, Bénard used a variety of means to visualize the structures he wanted to exhibit. They ranged from material substances he added to the liquid to optical contrivances such as lighting and the design of special photographic setups. His papers were abundantly illustrated with sketches and photographic clichés. Starting in 1904, he produced a series of films, which he used to analyze the phenomenon and showed at the Easter, 1914, meeting of the French Physical Society. The observation of self-organization in physical systems provided a formidable boost to those who wished to explain the phenomena of life in mechanical terms (D'Arcy Thomson). Bénard himself thought that physicists ought to be more ambitious in their pretension to understand nature, and this spontaneous emergence of organization struck him as having potentially important applications for the life sciences.

David Bloor

David Bloor (Visiting Scholar, University of Edinburgh, U.K.) is doing research on the history of aerodynamics which focuses on a scientific controversy about the reasons why an aircraft wing generates lift. British and German experts disagreed over this question up until the 1920s. Following the work of Kutta and Prandtl, German experts developed the circulation theory, while British workers, guided by the achievement of Rayleigh, initially developed the theory of discontinuous flow. The aim of the book is to explain this systematic divergence in approach. It is significant that the British entrusted their aeronautical research to a group dominated by Cambridge-trained mathematical physicists, while the German effort was led by mathematically sophisticated engineers and applied mathematicians from the Technische Hochschulen. One factor of great significance is the different attitudes of the two national groups to ideal fluid theory. German engineers treated it as a useful tool, while the British treated it as a physically false theory and tried to develop a systematic account of viscous flow.

Andrew Warwick (Visiting Scholar, Imperial College, London, U.K.) focused on the development of x-ray technology within a medical context in the decade after 1896. Taking Hamburg as an example, he showed that, contrary to received accounts, the initial wave of enthusiasm for x-rays as a medical tool was followed by a backlash in which x-rays were widely regarded as of little or no medical value. This disillusionment was generated by the new rays failing to fulfill the unrealistic expectations raised in medical minds by the notion of a new ray which allowed one to see inside the living human body much as an autopsy revealed the contents of a dead one. In practice, x-ray technology was too difficult for most doctors to use reliably, and even good pictures

required considerable skill to integrate into medical diagnosis and treatment. The research aims at investigating the notion of entrepreneurship in Germany circa 1900 in the form of the small group of doctors, technologists, engineers, and physicists who gradually and painstakingly made x-rays an indispensable tool to medicine.

Suman Seth

Suman Seth (Postdoctoral Fellow, Princeton University, U.S.A.) studies the practices of theoretical physics in Germany between 1890 and 1930. He has characterized aspects of the development of the field in terms of a dichotomy between two "kinds" of theoretical physics, distinguished by their methods, world-views, discourse, and techniques: what has been termed "the physics of principles," and what he terms "the physics of problems." The physics of principles, which had as its most prominent proponents Poincaré, Planck, Einstein, and Bohr, can be seen as the most significant continuation of—and response to—fin-de-siècle debates about the foundations of physics, offering in place of any particular materialist ontology a physics based on generalized principles. The physics of problems was both newer, beginning essentially with Sommerfeld's move to Munich in 1906, and largely avoided the questions of foundations, Sommerfeld once quipping to Einstein that "I can only further the engineering of the quantum [die Technik der Quanten]. You would have to make its philosophy." Others had the same impression, the Oxford physicist Frederick Lindemann writing to Einstein in 1933 that "I have the impression that anyone trained by Sommerfeld is the sort of man who can work out a problem and get an answer, which is what we really need at Oxford, rather than the more abstract type who would spend his time disputing with the philosophers." Where Planck, for example, promoted a practice of theoretical physics devoted to abstract, de-anthropomorphized, de-historicized, "pure" principles, Sommerfeld focused on specific problems, drawing these from a variety of sources, including six years spent teaching at an engineering college (Technische Hochschule), often emphasizing questions of economic or technological benefit. And where the physics of principles provided (indeed, provides) the dominant discourse of the new discipline, Sommerfeld's newer theoretical physics would supply the lion's share of its younger practitioners, training three generations of students, at least eight Nobel prize winners amongst them. Sommerfeld's many students adopted his way of seeing the physical world and his and their analytic practices represent a dominant strand in what the field came to be. Only by studying these two "kinds" of theoretical physics together can one begin to understand the formative years of a discipline that, to many, signified the pinnacle of scientific achievement for the twentieth century.

Richard Staley

Richard Staley (Visiting Scholar, University of Wisconsin-Madison, U.S.A.) seeks to deliver new perspectives on the material, conceptual and disciplinary foundations of physics in the period from 1870 to the 1920s. A primary focus (and the subject of a book manuscript in preparation) is a new account of the multiple lines of investigation—theoretical, experimental and instrumental—which coalesced, diverged and intersected anew to produce not only the history of relativity we currently recognize, but a more complex, contingent and involved story with a cast of unfamiliar characters and new themes. Why did Michelson and Morley never complete the ether-drift experiment as planned in 1887? How is the history of the screw relevant to the analysis of space and time in 1905? Who invented "classical" physics? There are several important methodological underpinnings to the project. The first is to follow the multiple threads of many actors with different trajectories and interests, as they work overlapping but not parallel lines of investigation. This means exploring the research concerns of the originator of the ether-drift experiment, and what he made of his experiment—a new instrument—rather than inquiring solely about crucial experiments or the use theorists made of the Michelson-Morley experiment. It means investigating the material culture of measuring space and time, in experimentalists' work to track the motion of electrons on minute photographic plates in 1905. It means exploring the formulation of concepts of "classical physics" in the work of a host of theorists after the arrival of Planck's quanta and Einstein's relativity in 1900 and 1905.

Robert M. Brain (Visiting Scholar, University of British Columbia, Canada) studied the "Pulse of Modernism: Experimental Physiology and Artistic Avant-Garde ca. 1900." Modernism is a term often used to express the changing sense of reality in turn-of-the-century arts and sciences. Very often modernism is invoked to join industrial modernity and the vanguard arts without a firm causal link between them. This paper demonstrates the indispensable role of the experimental physiology laboratory as the middle term between industrial procedures and artistic practices and ideologies. Proponents of physiological recording devices sponsored a skepticism towards traditional and consensual languages, methods, and institutions in favor of a new modernist focus on essential and formalized protocols, and a "Kantian" reflexion on the conditions of possibility of scientific knowledge. From the physiology laboratory these familiar modernist standards migrated into the ateliers of painters, poets, musicians, and architects. He describes several different pathways between labs and modernist artistic movements in both France and Germany, showing how experimental physiology was pressed into the service of a different kind of modernism in each country. French artists used physiological aesthetics to transform representational techniques but left the traditional categories of artistic spectatorship unchanged. German vanguards, by contract, joined physiology with home-grown notions of empathy (*Einfühlung*) and expression to create an aesthetics of the body-turned-inside-out, a relation of projection and recovery that would heal the ills of the division of labor in society. With the attempts of the Bauhaus and others to produce industrial artworks of everyday life, the transitive relation of industrialism, physiology, and artistic modernism came full circle.

The art historian ***Bettina Gockel*** (Visiting Scholar, Universität Tübingen, Germany) investigated Paul Klee's practice of picture making as a tool for making the invisible visible. The artistic materials, also marginal and every day materials, as well as line and color should become tools of pure invention while preserving an autonomous status of their own. The aim was to make an invisible reality visible that is to say to give it a specific presence. The investigation of the relation of Klee's concept of art "to make the invisible visible" with the "building" of his persona or self was studied on the foil of the problematic and finally unsatisfactory representational concept of the self-portrait, a genre which became incompatible with Klees radical questioning of traditional modes of representation after 1919.

Gadi Algazi (Visiting Scholar, Tel Aviv University, Israel) started his project on "Making Invisible Movement Visible: Norbert Elias's Motion Pictures." The challenge to the conventional sense of reality after 1900 was not limited to the natural sciences alone. It also had implications for the study of society, culture and history. This project focuses on some neglected attempts to rethink the social and cultural sciences under the impact of the emergence of new technologies and medial configurations. Its point of departure is a reconstruction of the methodological assumptions underlying Norbert Elias's early work.

How to make invisible movement visible? This was the question Norbert Elias was struggling with, as he spent his days in Parisian libraries in 1935, reading through existing cultural histories and putting together the elements of what was to become his major work, *The Process of Civilization*. No problem seems more difficult for historians than conceptualizing, portraying and explaining change; it is also the most common task they encounter. But in Elias's case, the problem posed itself in a particular, challenging way.

How can you reconstruct a historical process spanning hundreds of years, one that lies well beyond the reach of conventional history? It is through this long-term historical process, Elias assumes, that actors with a particular psychological make-up, capable of coping with the requirements of modern societies, have been formed. If practitioners of micro-history would later insist that some processes can only become visible under a microscope, Elias claims that structural changes in the standards of behavior or the organization of personality can only be perceived once we go beyond the usual time-frame of conventional historical reconstruction. One needs a telescope, if you will, in order

to discern a process of gradual structural change spanning hundreds of years. But how should one put together a body of evidence in order to make plausible the claim that this change indeed took place? And given such a corpus of evidence, how should it be manipulated in order to make that long-term, structured change—what Elias calls 'process' in the strict sense—visible?

The workshop "New Paths of Physical Knowledge. Science and the Changing Sense of Reality circa 1900" was held at the Max Planck Institute for the History of Science in November 11–14, 2004. The book will be published with Chicago University Press. Titles of papers and authors are given below in alphabetical order.

Science and the Changing Senses of Reality Circa 1900, H. Otto Sibum, editor

- *Auerbach's Dilemma—Introductory Essay*
- *Making Invisible Movement Visible: Norbert Elias's Motion Pictures* Gadi Algazi (Tel Aviv University)
- *Seeing Structure, Structuring Sight: Bénard's Cells and the Visualization of Self-Organization* David Aubin, (Université Marie at Pierre Curie, Paris)
- *Brownian Motion and Microphysical Reality c. 1900* Charlotte Bigg (MPIWG)
- *Sichtbarmachung, Common Sense and Construction in Fluid Mechanics: The Cases of Hele-Shaw and Ludwig Prandtl* David Bloor (University of Edinburgh)
- *The Pulse of Modernism: Experimental Physiology and Artistic Avant-Garde ca. 1900* Robert M. Brain (University of British Columbia, Vancouver)
- *From Phenomenology to Phenomenotechnique: The Role of Early-Twentieth-Century Physics in Gaston Bachelard's Philosophy* Cristina Chimisso (Open University, Milton Keynes)
- *Picture Making As a Tool for "Making the Invisible Visible" Paul Klee's Art and Persona* Bettina Gockel (Universität Tübingen)
- *"Pushing the Limits of Understanding": Debating Primitivism in Cultural Science, 1900–1930* Doris Kaufmann (Universität Bremen)
- *Ways of Seeing: Ludwik Fleck and Polish Debates on Perception of Reality, 1890–1947* Ilana Löwy (INSERM, Paris)
- *Inventing the 'World of the Infinitely Little': Physics and Instruments of Psychical Research in Britain circa 1900* Richard Noakes (Cambridge University)
- *The Question of Modernism: Herriman, Hilbert, Brouwer and Others* Herbert Mehrtens (TU Braunschweig)
- *Heredity and its Entities around 1900* Hans-Jörg Rheinberger (MPIWG)
- *Engineering the Quantum. Arnold Sommerfeld and the Older Quantum Theory, 1915–1925* Suman Seth (Cornell University, Ithaca)
- *World Views and Physicist's Experience of Disciplinary Change: On the Co-Creation of Classical and Modern Physics* Richard Staley (University of Wisconsin, Madison)
- *Rethinking the Early History of X-rays* Andrew Warwick (Imperial College, London)

Further Projects

By Means of Performance: Visualizing Science at Work (H. O. Sibum)

Historians of science have repeatedly argued that the concrete process of working in a laboratory or workshop can usually only be recovered with difficulty and incompletely from historical texts and illustrations. The performance of an historical experiment such as James Joule's paddle wheel experiment to determine the mechanical equivalent of heat has proved to be a fruitful method of uncovering essential experimental techniques and forms of knowledge. In the course of this long-term project several replicas of historical experiments have been built and the respective reenactments closely studied. This project is now taken a step further by exploring the potential encapsulated in filming the reenactments of past experiments in order to provide a new visual archive for historians of science. In collaboration with Wolfgang Engels and Falk Riess from the Universität Oldenburg and the film maker Roland Steiner (Oldenburg) the group is currently filming the various stages of the process of getting C.T.R. Wilson's cloud chamber experiment to work.

Practicing Theoretical Physics: Making Sense of Felix Auerbach's Notebooks (H. O. Sibum)

With the assistance of the Library the note books (approx. 11,000 pages) of the Jena theoretical physicist Felix Auerbach have been digitalized. These short hand writings of the years 1872–1920 are currently transcribed and will provide a rich resource to study the heterogeneous practices of theorizing in physics in this important developmental stage in physics.

Research Grants Received

Charlotte Bigg "Brownian Motion and Microphysical reality circa 1900" position subsidized by the Deutsche Forschungsgemeinschaft (DFG), 2–3 years.

Collaborations

Workshop "Intellectual Work as Labor" co-organized with M. Norton Wise and held at the University of California Los Angeles (UCLA), February 2004.

With Larry Stewart (University of Saskatchewan, Canada), Scientific instrument trade in the 18th century (especially electricity and magnetism).

Planned Workshop

"Practical Knowledge Traditions and Scientific Change, 1750–1870" to be held at the Max Planck Institute for the History of Science, Berlin, February 2007.

Working places in the MPIWG Library. Photo: Urs Schoepflin

Knowledge Management at the MPIWG

Urs Schoepflin (Library Head) and *Dirk Wintergrün* (Head of Information Technology)

Introduction

The Library and the Information Technology Group (IT-group) aim to provide optimal access to both electronic and print resources. Their mission is to provide the best possible information services to the research groups of the Institute. They aim to construct an effective infrastructure for research in the history of science by exploiting the potential of new media for scholarly work and for disseminating research results.

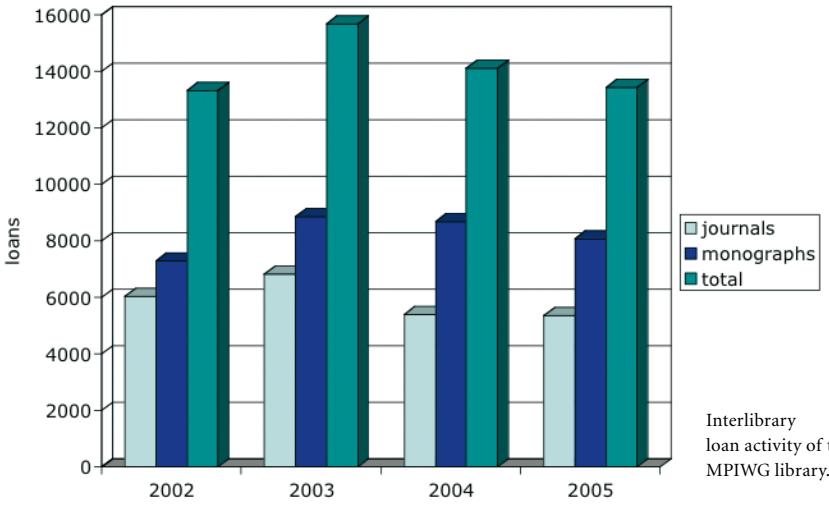
To meet the evolving needs of the research groups at the Institute, particular attention was given to four specific areas:

1. the development of the digital research library including the digitization services and the enhancement of content provision by the acquisition of archival materials,
2. the implementation of the common IT-infrastructure for publication and research,
3. the support of the publication and dissemination of research results by a copyright clearing service and additional publication aids including information on the Max Planck Society's open access policy and the corresponding eDoc server as central repository, and
4. the development of new web sites for research projects and the Institute's home page.

There have been recent discussions regarding the restructuring of the work of the IT-group and of the computer department. These emphasized the continuing focus of the IT-group on the content-driven development of innovative methods for research at the Institute, resulting in the integration of both groups into a new information technology unit (with effect from March 2006).

The Library's Collection and Services

The Library collections and services have been substantially developed in the past few years. It currently holds 60,000 volumes in print and 20,000 historic works in microform. Access to electronic resources has been enhanced to include over 18,000 electronic journals and more than 50 full text and reference databases, largely as a result of the "Grundversorgung" of the MPG. Complementing these resources, the interlibrary loan service has been in high demand and has attained a level of 14,000 loans p.a. This particular service priority of the Library allows for rapid document delivery providing books and articles from a wide network of national and international research libraries within days of a scholar's request.



Interlibrary loan activity of the MPIWG library.

Building a Common Infrastructure

The establishment of a common infrastructure for using the internet as a research and publication tool has made significant progress as projects of all research departments use the tools developed by the IT-group. The majority of internet projects are now based on a common open-source infrastructure which was developed within the framework of the ECHO initiative (European Cultural Heritage Online), integrating major research projects of the MPIWG, in particular the Virtual Laboratory and Archimedes (for project descriptions see the sections of the research departments of this report). Based on this integrative infrastructure, the Institute offers one of the largest research-related web sites within the Max Planck Society. The procedures developed in order to maintain this service have become a model for the design of the MPG wide platform for scholarly work in the humanities (Scholarly Workbench) in the framework of the eSciDoc Project, a project financed by the Federal Ministry of Research and Education and jointly realized by the MPG and the FIZ Karlsruhe and in which the MPIWG is a direct cooperation partner. This cooperation is part of the eSciDoc Project's concept to take up, generalize and maintain the successful research driven developments from individual institutes as a long term service to the scholarly community, a role which goes beyond the MPG Institutes' individual missions.

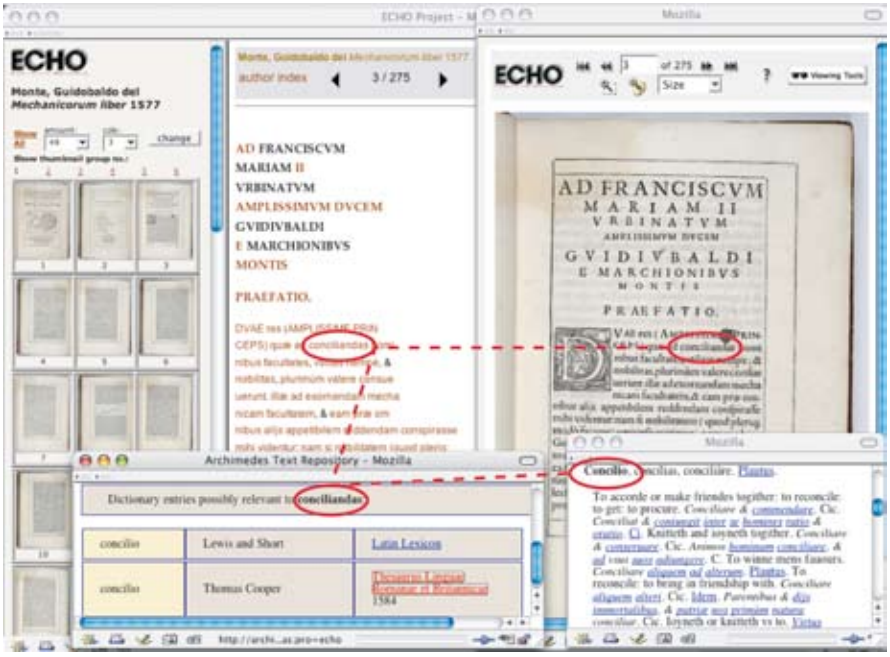
Digital Research Library and Enhanced Access to Content

The Library and the IT-group jointly have developed a special program for digitizing and presenting sources in the history of science in high quality color facsimiles from the Library's rare books collection and in greyscale images from the microform archive. All digitized materials are made available in a web-based Digital Research Library. The program includes the establishment of a special digitization group within the Library which is equipped and qualified to digitize material on a high professional standard at a rate of 500,000 pages p. a. The workflow comprises procedures to upload the resulting images to the online presentation environment of the Digital Research Library and to securely archive the master files. The service is designed to flexibly react to new demands in the short term. The program is working closely with the research groups at the Institute who present their research on the Internet and who can immediately integrate the digitized sources in their presentation (Archimedes Project, Virtual Laboratory, Epistemic History of Architecture, History of Mechanical Knowledge in China, Jesuit Sciences, Early Modern Engineering Drawings, Vision Project, Virtual Einstein Exhibition).

The Library has furthermore acquired and made available archival materials as major new research resources. The acquisition and digitization of the papers of the late German Physicist Ernst Gehrcke (1878–1960) allows for searchable electronic access to the entire collection of Gehrcke's papers and digitized newspaper clippings and thus represents an innovative model on how to make archival materials immediately accessible to the research groups at the Institute and also to a larger public at the Einstein Exhibition. The current acquisition and digitization of the complete microfilms of the Archive for the History of Quantum Physics will allow for web-based finding aids and for full electronic access to the materials of the archive. It will constitute a decisive scholarly resource for the newly established project group on the history of quantum physics. A further project on a novel image repository for the history of science is under way which will offer a searchable digital repository of images and illustrations pertinent to history of science.
This expansion of the scope of the Digital Research Library was in part made possible by additional funding from the special Library Program of the MPG aimed at innovative projects to enhance information provision at the institutes of the Humanities Section, for which the Library has successfully applied.

Basic Modules for Research Related Sites

The main focus of IT-development at the Institute is currently on tools for publishing primary sources and providing semantic access to these resources. Several research web sites, jointly maintained by the projects and the IT-group, give access to material relevant to their research.



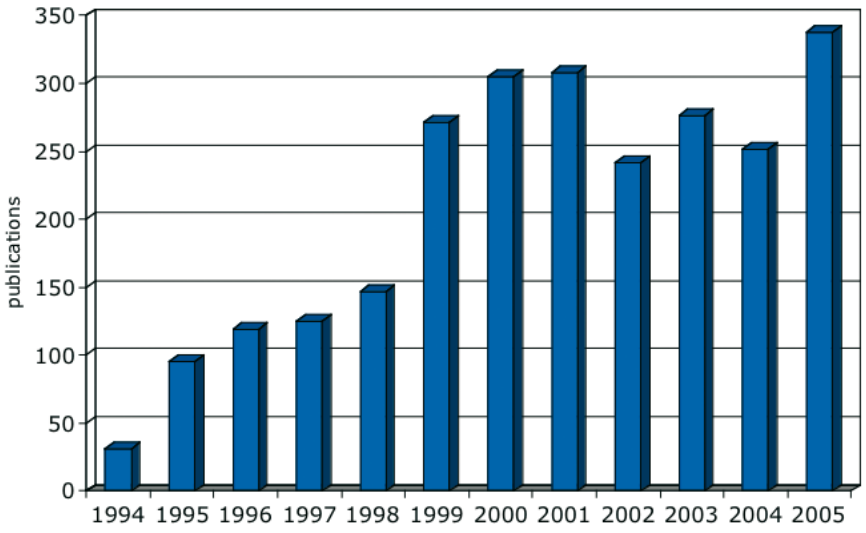
Basic infrastructure: environment for scholarly work.

The challenge is to provide a flexible infrastructure for a wide range of different purposes, covering e. g. integrated research libraries, image oriented documentation projects, or virtual exhibitions. The solution to these challenges is a modular structure in which the elements can be flexibly combined to new thematic web sites with only little additional work and a minimum of training for the scholars involved. The developed modules provide

1. an easy workflow to add new digitized material to the digital library,
2. a highly flexible image viewing environment,
3. a web based environment for the creation of electronic collections,
4. natural language technologies for the analysis of text written in a broad variety of languages,
5. an interface for integration of databases, and
6. tools for the design of textual and graphical navigation environments.

Support of the Scholarly Publication and Dissemination Process

To give authors adequate support in dealing with copyright issues, transfer agreements and publisher contracts, the Library has established a copyright clearing service and offers advice to authors on publisher contracts and copyright transfer agreements.



Publication activity of the scholars at MPIWG.

Following the open access policy adopted by the Max Planck Society to make available as many research results on the Internet as possible, the Library is responsible for uploading the Institute's bibliography and publication output (metadata and documents) to the MPG's central electronic repository for the documented research output of all institutes, the eDoc server. On this server, the searchable bibliographic data and—depending on the individual authors' agreements—the full text of the research results, presentations etc. are made available for either internal or open use.

To increase the acceptance of electronic publications particularly in the humanities, the publication process has to be as easy as possible and the added value has to be immediate for the researcher. Therefore, the tools to publish comprehensive documents comparable to a classical monograph will have to be improved and the possibility to set stable links to sources are on the agenda. One of the main perspectives for future developments at the Institute is the integration of the publications tools into an environment available at every work place, accompanied by improved access tools to existing electronic resources and environments for collaborative work.

Web Sites of the Institute

Web presentations became an integrated part of research in a different projects. These research web sites are jointly maintained by the researchers and the IT group, give access to material relevant to their research interests and are part of their dissemination strategies of research results. Currently, 9 research sites are available online (The Virtual Laboratory, European Cultural Heritage Online, Vision-Project, Humboldt Project, Einstein's Papers in the Annals of Physics, The Virtual Einstein Exhibition, the Cuneiform Digital Library Initiative (CDLI), Archimedes, Database of Mechanical Drawings) and 5 additional sites (Islamic Scientific Manuscripts, Encyclopaedia of Life Sciences, History of Quantum Physics) are in preparation.

Parallel to the development of research oriented sites, the main web site of the Institute was completely redesigned. It offers now a comprehensive description of all current research projects at the Institute. The content of the project descriptions, of the personal home pages, and of the conference pages can be updated by the scholars themselves through a specially developed web interface. Conference papers can be exchanged among participants as part of a collaborative working environment currently under development.

The institute provides on its external and internal web sites in total approx. 1,500,000 digital items, i. e. images, movies, full text and database entries.

Collaboration and Outreach

The Library and the IT-group were involved in several collaborative projects. The foremost two aims of cooperating with research and cultural institutions is on the one hand the sharing of rare and manuscript materials to enhance access to these resources for research purposes and on the other hand transfer of skills by sharing the expertise in maintaining digital projects to make these resources available on the internet. At MPG level, the ongoing cooperation with both the Bibliotheca Hertziana—MPI for Art History in Rome and with the Art History Institute—MPI in Florence is particularly relevant in these respects. Other important international cooperative projects include the Humboldt Project in Tenerife (Canary Islands) and the MPIWG's partner group at the Institute for the History Natural Sciences at the Chinese Academy of the Sciences in Beijing.
Possible new collaboration is explored in the framework of a delegation of the Humanities Section of the MPG visiting Ulan Bataar (Mongolia), where institutions holding cultural heritage were visited.

Finally, the Library and the IT-group were actively involved in discussions on the concept of the newly-founded Max Planck Digital Library (MPDL), which will consolidate the central information management services of the MPG and host the eSciDoc infrastructure project, to which the MPIWG information services provided by the Library and the IT-group form a model counterpart at the level of the MPG Institutes. The strategic cooperation with the MPDL will provide the necessary support for further generalizing and maintaining the services developed at the Institute, integrate new services and secure long term availability and archiving of the scholarly results in a reliable environment so crucial to research.

Overviews

Research Scholars

Beurton, Peter (Dr. rer. nat. 1973 [biology], Dipl. 1977 [philosophy] Humboldt-Universität zu Berlin, habil. phil. 1987 [philosophy] Universität Potsdam), at the Institute since September 1994. Area of work: Research strategies in biological evolutionary theory; modern darwinism and the philosophy of science.

Bigg, Charlotte (Ph.D. 2002 [history and philosophy of science] University of Cambridge), at the Institute since July 2005. Area of work: Social and cultural history of the physical sciences (physics, chemistry, astronomy) in the 19th and 20th centuries, especially the history of optical instrumentation.

Bödeker, Katja (Dipl. 1998 [psychology], Dr. des. 2004 [psychology] Freie Universität Berlin), at the institute since 1999. Area of work: Cognitive development; concept formation and culture; cognitive anthropology. Einstein exhibition project: Simple Einstein.

Brandt, Christina (Dr. rer nat. 2002 [history of science] Technische Universität Braunschweig), at the Institute as research scholar since June 2003. Area of work: On the history of cloning: A comparative analysis of biomedical research in Germany from 1950 to 2000.

Bührig, Claudia (Dipl.-Ing. 1991 [architecture] Universität Hannover, Dr. des. 2002 [architecture] Brandenburgische Technische Universität), at the Institute from November 2002 to May 2005. Area of work: Epistemic history of architecture.

Büttner, Jochen (Dipl. 1987 [physics] Freie Universität Berlin) at the Institute since 1988. Area of work: History of early modern mechanics.

Castagnetti, Giuseppe ([philosophy and history] University of Milano), at the Institute from October 1997 to September 2002 and since April 2003. Area of work: History of institutions of physics in the 20th century; political and social context of Albert Einstein's activities in Berlin. Einstein exhibition project.

Casties, Robert (Dipl. 1998 [physics] Universität Hamburg, Dr. phil. nat. 2002 [history and philosophy of science] Universität Bern), at the Institute since January 2002. Area of work: Information technology project.

Damerow, Peter (Dr. 1977 [mathematics] Universität Bielefeld, habil. 1994 [philosophy] Universität Konstanz), at the Institute since January 1997. Area of work: History of science and education; individual and historical development of cognition; genesis of writing and arithmetic; history of mathematics and physics in ancient and early modern period. Einstein exhibition project.

Daston, Lorraine (A.B. 1973 Harvard University, Dipl. 1974 University of Cambridge, Ph.D. 1979 [history of science] Harvard University), at the Institute since July 1995. Area of work: History of probability theory and statistics; history of scientific objectivity; attention and observation in natural history, 16th–19th cs.

Dierig, Sven (Dipl. 1990 [biology], Dr. rer. nat 1995 [neurobiology] Universität Konstanz, habil. 2005 [history of science] Technische Universität Berlin), at the Institute since July 1997. Area of work: Urbanization, industrialization, and the place of experiment in 19th century physiology; the virtual laboratory.

Feest, Uljana (M.A. 1994 [psychology] Goethe-Universität, Frankfurt/M.; Ph.D. 2003 [history and philosophy of science] University of Pittsburgh), at the Institute as Research Scholar since October 2004. Area of work: History and philosophy of scientific experimentation, especially psychology; history of the philosophy of science; relationship between the emergence of Gestalt psychology and logical positivism.

Fend, Mechthild (M.A. 1988 Universität Hamburg, Dr. phil. 1998 [art history] Goethe-Universität Frankfurt/M.), at the Institute from September 2001 to August 2005. Area of work: History and representation of skin in 18th and 19th century France.

Fuchs, Brian (B.A. 1979, M.Phil. 1983 [classics] Yale University), at the Institute since November 1999. Area of work: Project "Archimedes".

Geimer, Peter (Ph.D. [art history] Phillips Universität Marburg), at the Institute from March 2001 to March 2004. Area of work: Epistemology and aesthetics of graphical and photographic recordings (around 1900).

Heesen, Anke te (Dipl. 1990 [cult. pedagogy] Universität Hildesheim, Dr. phil. 1995 [aesthetics und communication] Universität Oldenburg), at the Institute since October 1999. Area of work: History of (natural history-) collections and exhibitions (18th to 20th Century); note-taking-practices of scientists; newspaper clippings and their status as information and visual fragment in the sciences and arts around 1900.

Hoffmann, Christoph (Dr. phil. 1995 [German literature], habil. 2004 [German literature] Europa Universität Viadrina Frankfurt (Oder), at the Institute since November 2004. Area of work: History of observation and experiment; technologies of representation; sensory physiology (19th and early 20th century); epistemic writings.

Hoffmann, Dieter (Dipl. 1972 [physics], Dr. phil. 1976 Humboldt-Universität zu Berlin, Dr. habil. 1989 [history of science] Humboldt-Universität zu Berlin, apl. Prof. 2003 Humboldt-Universität zu Berlin), at the Institute since December 1995. Area of work: History of physics in the 19th and 20th centuries, esp. institutional history of quantum theory and modern metrology; history of science in the GDR. Einstein exhibition project.

Hyman, Malcolm (Ph.D. 2002 [classical philology] Brown University), at the Institute since August 2004. Area of work: History of the language sciences; development of scientific terminology; science in Greek and Roman antiquity; linguistic computing; information architecture. Area of work: Project "Archimedes".

Kant, Horst (Dipl. 1969 [physics], Dr. rer. pol. 1973 [history & philosophy of science] Humboldt-Universität zu Berlin), at the Institute since October 1995. Area of work: History of physics in the 19th and 20th centuries (esp. atomic physics and institutional and social aspects).

Kern, Hartmut (M.A. 1988 [philosophy] Freie Universität Berlin), at the Institute since December 2001. Area of work: Information technology project.

Kleeberg, Bernhard (Dr. phil. 2002 [history] Universität Konstanz), at the Institute since September 2003. Area of work: 19th and 20th century political economy, evolutionary theory and anthropology, natural philosophy and theology, aesthetics of nature.

Klein, Ursula (Dr. phil. 1993, habil. 2000 [philosophy] Universität Konstanz), at the Institute from July 1995 to August 1997 and since July 1998. Area of work: History and philosophy of the laboratory sciences; history of technoscience; classification and historical ontology.

Kurapkat, Dietmar (Dipl.-Ing. 1998 [architecture] Technische Universität Karlsruhe), at the Institute since Oktober 2005. Area of work: Epistemic History of Architecture in connection with the archaeology of the Near East (especially the neolithic and early historic periods).

Kursell, Julia (Dr. phil. 2000 [Russian philology] Ludwig-Maximilians-Universität München), at the Institute since April 2004. Area of work: 20th century music and sound art; physiology and psychology of hearing (19th and 20th centuries).

Lefèvre, Wolfgang (Dr. phil. 1971 [philosophy], habil. 1977 [philosophy in connection with history of science] Freie Universität Berlin, apl. Professor [philosophy] Freie Universität Berlin), at the Institute since July 1994. Area of work: History of science in connection with history of philosophy on the basis of social history; sciences in Greek antiquity; early modern physics and chemistry; history of biology (15th–18th centuries).

Lehner, Christoph (Dipl.-Phys. 1989 Universität München, Ph.D. [philosophy of science] 1997 Stanford University), at the Institute since January 2004. Area of work: History of modern physics, philosophy of physics, history of modern philosophy. Einstein exhibition project.

Lund, Hannah Lotte (M.A. 1999 [history/literature] Humboldt-Universität zu Berlin), at the institute as coordinator at the network "history of scientific objects" since 2005. Area of work: Intellectual (women's) history; 18th century European cultural history.

Maroldt, Jean (ingénieur [electronics and nuclear physics] ENSEM, Nancy, Ph.D. [applied mathematics] Université Henri Poincaré, Nancy), at the Institute as research scholar from May 2002 to April 2004. Area of work: Project "ECHO".

Müller-Wille, Staffan (Dipl. 1992 [palaeontology] Freie Universität Berlin, Dr. 1997 [philosophy] Universität Bielefeld), at the Institute from December 2000 to September 2004. Area of work: The structural turn in genetics and anthropology 1880–1950.

Neffe, Jürgen (Dr. rer. nat. 1985 [biochemistry] RWTH Aachen, at the Institute from August 2002 to June 2004. Area of work: Life and work of Albert Einstein; Life and work of Charles Darwin; theory of evolution; Open Access; European Cultural Heritage Online (ECHO).

Oertzen, Christine von (Dr. phil. 1998 [history] Freie Universität Berlin), at the Institute since June 2005. Areas of work: Academic organisations, networks, and biographies; science and gender in connection with social and cultural history, history of academic cultures in Europe and the United States, 19th and 20th centuries.

Pietsch, Annik (Diplom 1988 [biochemistry] Freie Universität Berlin, B. A. 1990 [history of art] Technische Universität Berlin), at the Institute since July 1999. Area of work: Binding media. Painting techniques in art, science, and industry in 18th and 19th century Germany.

Presas i Puig, Albert (Dr. phil. 1995 [history of science] Technische Universität Berlin), at the Institute January and February 2003 and since May 2003. Area of work: Scientific relationship between Germany and Spain: Science, technological transfer, and international policy in the 20th century.

Renn, Jürgen (Dipl. 1983 [physics] Freie Universität Berlin, Dr. rer. nat. 1987 [mathematics] Technische Universität Berlin), at the Institute since March 1994. Area of work: History of early modern mechanics, history of relativity theory; interaction between cognitive and contextual factors in the history of science. Einstein exhibition project (Scientific Director).

Rheinberger, Hans-Jörg (M.A. 1973 [philosophy], Dipl. 1979 [biology], Dr. rer. nat. 1982, habil. 1987 [molecular biology] Freie Universität Berlin), at the Institute since January 1997. Area of work: Epistemology of experimentation.

Rieger, Simone (M.A. 1998 [linguistics and philosophy] Technische Universität Berlin), at the Institute since February 1999. Area of work: Project "ECHO".

Schemmel, Matthias (Dipl. 1997 [physics], Universität Hamburg), at the Institute since January 1998. Area of work: History of relativity theory, history of early modern mechanics, history of Chinese science.

Schmidgen, Henning (Dipl. 1990 [psychology], Dr. phil. 1996 [psychology], M.A. 1997 [philosophy] Freie Universität Berlin), at the Institute from March 1997 to August 2005. Area of work: Machines and bodies without organs in the history of science.

Schnöpf, Markus (M.A. 2001 [history, history of medicine] Freie Universität Berlin), at the Institute as research scholar from July 2001 to February 2005. Area of work: Project "Archimedes", Proyecto Humboldt.

Schoepflin, Urs (Dipl. 1975 [sociology] Freie Universität Berlin), at the Institute as director of the library since September 1994. Area of work: Scientific information systems; scholarly communication; sociology and history of science; scientometrics; digital libraries; open access.

Schüller, Volkmar (Dr. rer. nat. 1972 [physics] Universität Greifswald); at the Institute since September 1994. Area of work: History of mathematics and physics (16th and 17th centuries).

Sibum, H. Otto (Dr. rer. nat. 1989 [physics] Carl von Ossietzky Universität Oldenburg; habil. 2001 [history of science and technology] Technische Universität Carolo-Wilhelmina zu Braunschweig), at the Institute since October 1995. Area of work: History of the physical sciences (17th until 20th century), particularly history of experience and experiment, embodiment of knowledge, material culture of science, precision measurement.

Steinle, Friedrich (Dipl. 1982 [physics], Dr. rer. nat. 1990 [history of science] Universität Tübingen, Privatdozent 2000 [history and philosophy of science] Technische Universität Berlin), at the Institute from October 1997 to March 1998 and from August 1999 to August 2004. Area of work: Experiment and concept formation–Charles Dufay and the two electricities.

Valleriani, Matteo (Laurea 1990 [philosophy]), at the Institute since July 1998. Area of work: Galileo as an Engineer. Einstein exhibition project: Knowledge and conception of the world.

Vidal, Fernando (A.B. 1981 Harvard University; M.A. 1984 [psychology] University of Geneva; M.A. 1986 [history and philosophy of science] University of Paris I – Sorbonne; Ph.D. 1988 University of Geneva; Habilitation 2001 Ecole des Hautes Etudes en Science Sociales), at the Institute as research scholar since September 2000. Area of work: History of psychology and anthropology, 16th–20th centuries; the self and the body in the Christian tradition; historicizing "brainhood" (the self as brain); miracles as epistemic things.

Vogt, Annette (Diplom 1975, Dr. rer. nat. 1986 [mathematics] Karl-Marx-Universität Leipzig), at the Institute since September 1994. Area of work: Women in science from a European perspective, between 1900 and 1945; case studies on women in science at the Berlin University and in the Kaiser-Wilhelm-Gesellschaft.

Wazeck, Milena (Dipl. 2001 [political science] Freie Universität Berlin), at the Institut since June 2000. Area of work: Amateur science around 1900, public reception of relativity; amateur scientists' opposition to the theory of relativity in the early 20th century; Einstein exhibition project.

Wilder, Kelley E. (D.Phil. 2003 [history of art] Oxford University), at the Institute since 1 September 2005. Area of work: History of photography; Imaging in the Sciences.

Wintergrün, Dirk (Dipl. 1998 [physics] Technische Universität Berlin), at the Institute since January 2000. Area of work: Information technology project.

Visiting Scholars and Research Fellows

Dr. Oscar Joao Abdounur (Visiting Scholar, Universidade de Sao Paulo, Sao Paulo, Brazil, February 8–March 5, July 13–August 8, 2004, February 8–March 6, June 25–August 7, 2005, and December 10, 2005–January 6, 2006): The relationship between mathematics and music in the history of science.

Dr. Tara Abraham (Postdoctoral Research Fellow, October 1, 2002–June 30, 2004): Theoretical methods in studies of the nervous system, 1930–1950.

Prof. Dr. Gadi Algazi (Visiting Scholar, Tel Aviv University, Israel, July 15–August 31, 2004 and July 15–August 31, 2005): Making invisible movement visible: Norbert Elias' motion picture.

Dr. des. Jan Altmann (Postdoctoral Research Fellow, May 15–July 14, 2005 and September 1, 2005–August 31, 2006): Drawing as a technique of scientific observation.
Nancy Anderson (Rathenau Postdoctoral Research Fellow, October 1, 2002–September 30, 2004): Electronic imaging and cell biology, 1945–1995.

Prof. Dr. Bernard Andrieu (Visiting Scholar, Archives Poincaré UMR 7117 Centre National de la Recherche Scientifique/Université Nancy 2, France, July 1–July 31, 2005): Project: Knowledge and Belief.

Dr. Aitor Anduaga (Postdoctoral Research Fellow, Faculty of Modern History, University of Oxford, UK, March 1– June 15, 2005): Ionosphere and Radio Industry in Germany in the Interwar Years.

Prof. Dr. Bethania Assy (Visiting Scholar, Deutscher Akademischer Austauschdienst, Universidade do Estado do Rio de Janeiro, Brazil, June 4–August 4, 2005): Historical investigation on 16th century rational authority of natural human rights based on man inherent attributes.

Dr. David Aubin (Visiting Scholar, Institut de mathématiques de Jussieu, Université Paris 6, France, August 9–September 19, 2004): Fluid mechanics, war, and cinema in France 1900–1920.

Dr. Safia Azzouni (Postdoctoral Research Fellow, October 1, 2004–September 30, 2006): The popular science book: A new genre between literature and science in the late 19th and early 20th century.

Dr. Monika Baár (Postdoctoral Research Fellow, September 1, 2003–August 31, 2005): Nationalism and nineteenth-century historiography in Europe (Project: Knowledge and Belief).

Dr. Massimiliano Badino (Visiting Scholar, Dipartimento di Filosofia, Università degli Studi di Genova, Italy, June 1, 2005–May 31, 2006): Thermodynamics and statistical mechanics from Boltzmann to Planck.

Dr. Angela Bandinelli (Postdoctoral Research Fellow, Istituto e Museo di Storia della Scienza, Uinersità degli Studi di Firenze, Italy, May 1–June 30, 2004): Chemistry of life between the eighteenth and the nineteenth centuries.

Dr. Erik Banks (Visiting Scholar, Fulbright Program, September 15, 2004–July 15, 2005): Space and time in natural philosophy with special emphasis on Bernhard Riemann.

Dr. Antonio Becchi (Postdoctoral Research Fellow, Dipartimento di Scienze per l'Architettura, Universitá di Genova, Italy, January 1, 2004–December 31, 2005): Epistemic history of architecture.

Naomi Beck (Predoctoral Research Fellow, Université de Paris 1 – Phanthèon – Sorbonne, France, October 1, 2004–July 31, 2005): Late 19th century evolutionism: The diffusion and political interpretations of Herbert Spencer's theory in France and Italy (1870–1914).

Prof. Dr. Jenny Beckman (Visiting Scholar, Riksbankens jubileumsfond (The Bank of Sweden Tercentenary Foundation), Avd. för vetenskapshistoria, Uppsala universitet, Sweden, February 1–April 30, 2005): Crossing borders in the kingdoms of nature: Amateurs in science, 1880–2000.

Prof. Dr. Domenico Bertoloni-Meli (Visiting Scholar, Department of the History and Philosophy of Science, Indiana University, Bloomington, USA, April 1–June 30, 2004): History of seventeenth-century mechanics.

Prof. José Ramón Bertomeu-Sánchez (Visiting Scholar, Departament d'Història de la Ciènca i Documentació, Facultat de Medicina, Universitat de València, Spain, April 1–August 31, 2004): Instruments, chemistry and crime: Black boxing Marsh's test for arsenic in European toxicology, 1836–1845.

Prof. Dr. David Bloor (Visiting Scholar, Science Studies Unit, University of Edinburgh, UK, October 1, 2003–August 31, 2004): Rival theories of aerofoil, 1904–1926.

Arianna Borrelli (Postdoctoral Research Fellow, September 1, 2005–February 28, 2007): Heat and cold in observations and explanations of natural philosophers and scientists.

Dr. Elena Bougleux (Visiting Scholar, Centro di ricerca sull'Antropologia e l'Epistemologia della complessità, Università degli Studi de Bergamo, Italy, September 15–November 30, 2004): Einstein exhibition project: Einstein's world today.

Prof. Dr. Marie-Noëlle Bourguet (Visiting Scholar, Université de Paris 7, France, October 13, 2003–May 15, 2004, September 11–September 26, 2004 and August 28–September 19, 2005): Alexander von Humboldt's voyage to Italy (Project: Knowledge and Belief).

Prof. Dr. Robert Brain (Visiting Scholar, University of British Columbia, Vancouver, Canada , May 1–May 31, 2005): The pulse of modernism: Experimantal physiology and artistic avant-garde ca. 1900.

Dr. Brita Brenna (Postdoctoral Research Fellow, Universitetet i Oslo, Norway, August 15, 2005–January 15, 2006): Nature in an 18th century natural history of Norway: Making common land for god, the king, science, and the public.

Björn Brüsch (Predoctoral Research Fellow, January 1, 2004–December 31, 2006): Experimentalization of gardening in 19th century Germany: Peter Joseph Lenné and the "Gärtner-Lehranstalt" in Wildpark/Potsdam.

Luciana Vieira Caliman (Predoctoral Research Fellow, Deutscher Akademischer Austauschdienst, Instituto de Medicina Social—IMS/VERJ, Laranjeiras, Rio de Janeiro, Brasilien, April 1, 2004–August 31, 2006): The inattentive individual: Contributions to the history of attention.

Prof. Mary Baine Campbell (Visiting Scholar, Brandeis University, Department of English and American Literature, Brandeis University, Waltham, Massachusettes, USA, July 1–August 31, 2004): Theory of dreams in early modern France and England (Project: Knowledge and Belief).

Prof. Dr. Rüdiger Campe (Visiting Scholar, German Department, Johns Hopkins University, Gilman Hall, Baltimore, Maryland, USA, June 16–July 31, 2004): Procedures and techniques of writing and notation in the seventeenth and eighteenth centuries—an archeological project on Lichtenberg's "wastebooks".

Zeynep Celik (Predoctoral Research Fellow, Center for Advanced Study in the Visual Arts (CASVA) Fellowship, Massachusetts Institut of Technology, USA, January 15, 2005–August 31, 2006): Kinaesthetic impulses: Space, performance and the body in German architecture, 1870–1918.

Dr. Soraya de Chadarevian (Visiting Scholar, Department of History and Philosophy of Science, University of Cambridge, UK, October 1, 2004–September 30, 2005): History of radiation biology and genetics after 1945.

Yue Chen (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, June 17–July 10, 2004, September 16–November 15, 2004 and September 26–November 30, 2005): The history of mechanics (Project: Development of mechanical knowledge in China).

Markus Christen (Predoctoral Research Fellow, Institut für Neuroinformatik, Universität/ETH Zürich, Switzerland, December 20, 2004–May 15, 2005): History of neural coding and neural computation.

Dr. Jacob Lebovitch Dahl (Postdoctoral Research Fellow, Centre National de la Recherche Scientifique, Paris, France, October 1, 2005–September 30, 2007): Research within the Framework of the CDLI Project.

Dr. Didier Debaise (Postdoctoral Research Fellow, October 1, 2005–September 30, 2007): Constructing a speculative approach to heredity on the basis of Sonigo's work.

Dr. Emmanuel Didier (Visiting Scholar, Centre de recherche sociologiques sur le droit et les institutions pénales (CESDIP)/Immeuble Edison, Guyancourt, France, March 1–August 31, 2006)

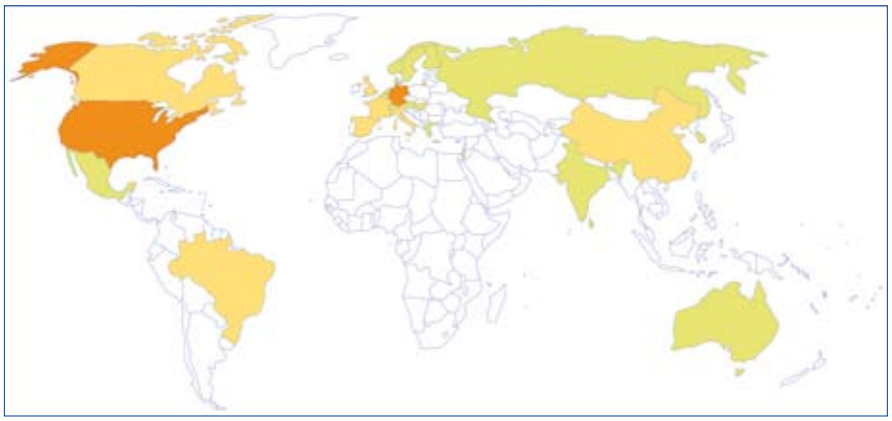
Thomas Dohmen (Predoctoral Research Fellow, University of Haifa, Israel, May 15–November 14, 2005): Context and error in the epistemology of scientific experiment.

Igal Dotan (Postdoctoral Research Fellow, Department of Philosophy, University of Haifa, Israel, November 15, 2004–November 14, 2006): Science in crisis and progress.

Prof. Dr. Circe Mary Silva da Silva Dynnikov (Visiting Scholar, Uni versidade Federal do Espirito Santo, Vitória, Brazil, September 7–October 6, 2004 and September 20–October 20, 2005): The reception of the theory of relativity in Brazil, Einstein exhibition project.

Dr. Matthew Eddy (Postdoctoral Research Fellow, Dibner Institute for the History of Science and Technology—MIT, Cambridge, Massachusetts, USA, July 1–July 31, 2004): The chemical foundations of the Huttonian debates in enlightenment Edinburgh.

Karen Encarnacion (Predoctoral Research Fellow, Deutscher Akademischer Austauschdienst, October 1, 2002–January 31, 2004): Visual experience in the sixteenth century—anatomy and midwifery texts (Project: Common Languages of Art and Science).



1–5 Scholars 5–20 Scholars more than 20 Scholars

Prof. Rand B. Evans (Visiting Scholar, East Carolina University, Greenville, USA, January 1–December 31, 2005): Brass instrument psychology: A history of scientific instruments used in psychological research and demonstration, 1840–1940.

Dr. Pasi Falk (Visiting Scholar, Helsinki Collegium for Advanced Studies, University of Helsinki, Finland, January 16– February 15, 2005): Digital truth: The role of digital technology and digital thinking in the production of scientific knowledge.

Prof. Dr. Zaiqing Fang (Visiting Scholar, Chinese Academy of Science, Institute for the History of Natural Siences, Beijing, China, June 19–July 18, 2004, February 28–March 17, 2005 and September 10–September 19, 2005): Development of mechanical knowledge in China.

Prof. Dr. Rivka Feldhay (Visiting Scholar, The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel, July 1–July 31, 2004 and October 1, 2005–March 31, 2006): Jesuits on statics, dynamics, mathematics and astronomy between Galileo and Newton.

Philipp Felsch (Predoctoral Research Fellow, VolkswagenStiftung, Humboldt-Universität zu Berlin, February 1, 2002–January 31, 2005): Laboratory landscapes. The alps as medium of physiology around 1900.

Prof. Michel Ferrari (Visiting Scholar, The Ontario Institute for Studies in Education of the University of Toronto, Joint Centre for Bioethics, Department of Human Development and Applied Psychology, Ontario, Canada, February 1–March 31, 2005): History of psychology.

Dr. Dr. Erna Fiorentini (Visiting Scholar, Deutsche Forschungsgemeinschaft/SFB 1957 "Aesthetic Experience and the Dissolution of Artistic Limits", Institut für Kunstgeschichte, Freie Universität Berlin, Germany, January 1, 2003–December 31, 2006): Protomodern observers and the camera lucida (Project: Common Languages of Art and Science).

Mickaël Fonton (Predoctoral Research Fellow, Équipe REHSEIS, Centre Javelot, Centre National de la Recherche Scientifique/Université Paris 7, France, May 1–May 31, 2004): Laboratory, observatory, and field: the physicists and the construction of a new meteorology. France, Europe 1878–1914.

Paul Forman (Visiting Scholar, National Museum of American History, Smithsonian Institution, Washington, DC, USA, August 8–October 4, 2005): The modern-to-postmodern transition in culture, society, and science, and the putative relation between science and technology as indicative of that transition.

Christian Forstner (Predoctoral Research Fellow, Lehrstuhl für Wissenschaftsgeschichte, Universität Regensburg, Germany, May 1–July 31, 2005): History of physics in the 20th century, esp. quantum mechanics and Cold War, Interpretations of quantum mechanics.

Prof. Maria Cristina Franco Ferraz (Visiting Scholar, Department of Communication, Universidade Federal Fluminense, Rio de Janeiro, Brazil, July 1–August 20, 2004): Modernization of perception in the nineteenth century.

Prof. Dr. Tibor Frank (Visiting Scholar, Alexander-von-Humboldt-Stiftung, Eötvös Loránd Tudományegyetem, Budapest, Hungary, September 1, 2003–August 31, 2004): German-Hungarian connections in science and culture, 1919–1945.

Prof. Dr. Gideon Freudenthal (Visiting Scholar, The Cohn Institute for the History and Philosophy of Science and Ideas, Tel Aviv University, Israel, August 1–August 31, 2004 and July 1–July 31, 2005): Kant's and Maimon's philosophy of mathematics.

Dr. Claire Gantet (Postdoctoral Research Fellow, Centre de Recherches d'Histoire Moderne, Université de Paris I, France, September 1, 2003–September 30, 2005): Knowledge about dreams in the holy Roman empire, c. 1500–c. 1750 (Project: Knowledge and Belief).

Dr. Delphine Gardey (Visiting Scholar, Alexander-von-Humboldt-Stiftung, Centre de Recherche en Histoire des Sciences et des Techniques (CRHST), Paris, France, September 1, 2003–August 31, 2004): The female body and technoscience in the West during the 20th century.

Prof. Dr. Rodolphe Gasché (Visiting Scholar, University of Buffalo, New York, USA, June 15–July 31, 2005): Jan Patocka's care of the soul and Edmund Husserl's Lebenswelt.

Mauricio Gatto (Predoctoral Research Fellow, October 1, 2004–March 31, 2005): Early modern mechanical texts in the tradition of the Aristotelian mechanical problems.

Dr. Bernd Gausemeier (Postdoctoral Research Fellow, October 1, 2004–September 30, 2006): Genealogy and human heredity in Germany, ca. 1850–1945.

Dr. Zae Young Ghim (Visiting Scholar, Korea Science and Engineering Foundation, Science Culture Research Center, Research Institute for Basic Sciences, Seoul National University, Korea, November 1, 2002–October 30, 2004): History of quantum field theory in 1930s.

Prof. Dr. Hannah Ginsborg (Visiting Scholar, American Council of Learned Societies (ACLS) grant, Department of Philosophy, University of California, Berkeley, USA, September 1, 2004–July 25, 2005): The normativity of nature: empirical conceptualization, aesthetic experience and teleology in Kant's "Critique of Judgement".

Elodie Giroux (Predoctoral Research Fellow, Fondation Treilles, Unité de Formation et de Recherche (UFR) de Philosophie, Université Paris 1—Panthéon Sorbonne, Paris, France, October 1, 2005–May 15, 2006): Risk Factor Approach to Disease: Shifts in Medical Thought and Practice.

Dr. Bettina Gockel (Visiting Scholar, Kunsthistorisches Institut, Eberhard-Karls-Universität, Tübingen, Germany, February 15–March 31, 2005): Colour and light in 18th-century arts and sciences; history of perception; history of the relation of art and psychiatry; the avant-garde artist in the system of arts and sciences, 1860s to 1930s .

Dr. Frédéric Graber (Postdoctoral Research Fellow, Centre Alexandre Koyré, Paris, France, September 15, 2005–February 28, 2007): Places of knowledge of engineering in French and German public works (18th and 19th century).

Christelle Gramaglia (Predoctoral Research Fellow, Centre de Sociologie de l'Innovation, Ecole des Mines, Paris, France, September 1, 2005–August 31, 2006): Eco-oxicology and expert/lay observations on pollution. The development of bioindicators and biomarks and contemporary questions on observation and visual proof.

Dr. Birgit Griesecke (Postdoctoral Research Fellow, Emmy Noether-Forschungsgruppe "Kulturgeschichte des Menschenversuchs", Universität Bonn, Germany, September 19–December 31, 2005): The foreignness of science.

Thomas O. Haakenson (Predoctoral Research Fellow, Fulbright Program, Department of Cultural Studies and Comparative Literature, University of Minesota, Twin Cities, USA, September 1, 2002–July 31, 2004): The uncultured eye: Scientific knowledge, visual culture, and German national policy from 1871 to 1933 (Project: Common Languages of Art and Science).

Prof. Dr. Don Handelman (Visiting Scholar, The Hebrew University of Jerusalem, Israel, September 1–December 31, 2004): Bureaucratic logic of modern social orders.

Dr. Kristen Haring (Postdoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, USA, October 1, 2003–May 31, 2004): Technical identity in post-World War II America (Project: Knowledge and Belief).

Dr. Jonathan Harwood (Visiting Scholar, Centre for the History of Science, Technology and Medicine, The University of Manchester, UK, October 1– December 31, 2005): Europe's green revolution: the rise and fall of peasent-oriented plant-breeding in Central Europe, 1890–1945.

Dr. Michael Hau (Visiting Scholar, Australian Research Council, School of Historical Studies, Monash University, Victoria, Australia, November 1, 2005–January 31, 2006): High performance in elite sports: A cultural history of medicine, psychology, and society during the Weimar republic and nazism, 1918–1945.

Christophe Heintz (Predoctoral Research Fellow, Institut Jean-Nicod, Paris, France, January 1–June 30, 2004): Cognitive anthropology of mathematics.

Dr. Jörn Henrich (Postdoctoral Research Fellow, November 1, 2003–June 30, 2005): The specification of our scientific intuitions by Laplace.

Dr. Elfrieda Hiebert (Visiting Scholar, October 1–October 31, 2005): Pianists, composers, and pianos in the changing landscape of late 19th century musical acoustics.

Prof. Dr. Erwin N. Hiebert (Visiting Scholar, Department of the History of Science, Harvard University, Cambridge, Massachusetts, USA, October 1–October 31, 2005): History of the physical sciences since 1800. The lagacy of "Helmholtz's Tonempfindungen" in England.

Dr. Giora Hon (Visiting Scholar, German-Israeli Foundation for Scientific Research and Development (GIF), Department of Philosophy, University of Haifa, Israel, July 1–July 31, 2004 and July 1–July 31, 2005): History of the concept of symmetry.

Prof. Dr. Michel Janssen (Visiting Scholar, Program in History of Science and Technology, University of Minnesota, Minneapolis, USA, July 10–July 31, 2004 and November 4–November 13, 2004): The genesis of relativity.

Dr. Sarah Tindal Kareem (Postdoctoral Research Fellow, August 15, 2003–January 15, 2004): The concept of "Willing suspension of disbelief" as it developed during the long eighteenth century (Project: Knowledge and Belief).

Prof. Dr. Doris Kaufmann (Visiting Scholar, Institut für Geschichte, Universität Bremen, Germany, March 1–July 31, 2004): The debate on primitivism in Germany, France and the United States in the early 20th century.

Susanne B. Keller (Postdoctoral Research Fellow, September 1, 2005–August 31, 2007): Picturing the inaccessible: The gaze under the earth's surface between empiricism and speculation, 18th to 20th century.

Luciana Kind (Predoctoral Research Fellow, CAPES (Brazilian agency for the advanced training of university personnel), Universidade do Estado do Rio de Janeiro, Brazil, July 4–December 15, 2005): The history of brain death definition.

Cornelia Kleinitz (Postdoctoral Research Fellow, January 1–December 31, 2005): ECHO project: cultural heritage from Sudan and Mali.

Dr. Alexei Kojevnikov (Visiting Scholar, Institute for the History of Science, Moscow, Russia, June 22–July 21, 2004): History of quantum physics.

Dr. Sachiko Kusukawa (Visiting Scholar, Trinity College, Cambridge, UK, October 1–November 30, 2004): "Scientific illustration" in early modern Europe and protestant natural philosophy.

Dr. Sofie Lachapelle (Postdoctoral Research Fellow, History Department, University of Guelph, Ontario, Canada, October 1, 2002–December 31, 2004 and June 1–August 31, 2005): The relationship between theory formation and disciplinary organization in the creation of French psychology.

Dr. Jens Lachmund (Postdoctoral Research Fellow, Faculteit der Cultuur-wetenschappen, Universiteit Maastricht, The Netherlands, April 1–June 3, 2005): The making of an urban ecology. Biology and wildlife protection in post WWII Berlin.

Britta Lange (Postdoctoral Research Fellow, October 1, 2005–September 30, 2007): A History of the "Typic" scientific researches in warcamps from 1915 to 1918.

Prof. Dr. Manfred Laubichler (Visiting Scholar, Department of Philosophy, Arizona State University, Tempe, USA, January 1–July 31, 2004, December 10, 2004 –January 17, 2005 and May 15–July 31, 2005): History of theoretical biology, 1900–1945; The phenomenon of regulation and the origin of theoretical biology .

Dr. Sicco Lehmann-Brauns (Postdoctoral Research Fellow, September 1, 2003–August 31, 2005): The struggle about the age of the world; new strategies of historical knowledge in 17th and 18th century and the decline of biblical chronology (Project: Knowledge and Belief).

Dr. Rhodri Lewis (Postdoctoral Research Fellow, Jesus College, Oxford, UK, September 1, 2005–August 31, 2007): Reception and development of the classic arts of memory (mnemotechnics) in Northern Europe, 1500–1700.

Dr. Leoncio López-Ocón (Visiting Scholar, Departamento de Historia de la Ciencia, Instituto de Historia – CSIC, Madrid, Spain, August 1–August 31, 2004): The reception of Humboldtian science in Latin America and Spain in the nineteenth century.

Dr. Laurent Loty (Visiting Scholar, Université Rennes 2, France, January 1–January 31, 2004): Project: Knowledge and Belief.

Dr. Abigail Lustig (Rathenau Postdoctoral Research Fellow, University of Texas, Austin, USA, August 1, 2003–August 31, 2004): Explanations of altruism, cooperation, and social behavior in humans and other animals from Darwin through sociobiology; history of natural history and systematics, particularly botany and horticulture, from the eighteenth through the twentieth centuries.

Anna Märker (Postdoctoral Research Fellow, Department of Science and Technology Studies, Cornell University, Ithaca, New York, USA, October 1, 2005–February 28, 2007): The notion of "useful knowledge" and the emergence of modern science, 1750-1850.

Scott Mandelbrote (Visiting Scholar, University of Cambridge, Peterhouse, UK, March 15–April 15, 2004, July 1–August 31, 2004 and August 15–August 31, 2005): The uses of natural theology in seventeenth-century England.

Dr. Jennifer Anne Marie (Karl Schädler Postdoctoral Research Fellow, Liechtenstein Fonds for the History of Science, April 1, 2004–September 30, 2005): Gardening, fancying, and heredity.

Dr. Andreas Mayer (Visiting Scholar, The Wellcome Trust, University of Cambridge, UK, July 26–August 31, December 1–December 31, 2004 and August 1–September 30, 2005): The study of human and animal locomotion systems: Rise and fall of Etienne Jules Marey's physiological station.

Prof. Dr. Peter McLaughlin (Visiting Scholar, Philosophisches Seminar der Universität Heidelberg, Germany, July 1–October 31, 2004 and July 1–October 31, 2005): Project: Archimedes.

Dr. Alexandre Métraux (Visiting Scholar, Otto-Selz-Institut, Universität Mannheim, Germany, February 1–May 31, 2004): Art machines.

Prof. Dr. Reinhard Mocek (Visiting Scholar, September 1–December 31, 2004): The scientific correspondence of Alfred Kühn (1885–1968).

Dr. Amos Morris-Reich (Postdoctoral Research Fellow, Minerva Foundation, Institute of Contemporary Jewry, The Hebrew University of Jerusalem, Israel, September 1–October 31, 2005): Race and humanism: The epistemology of Arthur Ruppin.

Prof. Dr. Dorothea von Mücke (Visiting Scholar, Columbia University, New York, March 8–April 6, 2005): Authorship and the order of nature. Models of creativity and originality in the arts and sciences in the eighteenth century.

Kathrin Müller (Predoctoral Research Fellow, Gerda Henkel Stiftung, Universität Hamburg, Germany, October 13, 2003–June 30, 2005): Astronomical and cosmological images of the 12th and 13th centuries (Western Europe) (Project: Knowledge and Belief).

Tania Munz (Predoctoral Research Fellow, Department of History, Princeton University, New Jersey, USA, January 15–March 31, 2004): Of bird and bees: Karl von Frisch, Konrad Lorenz and the science of animals in Germany.

Dr. Anita Kildebaek Nielsen (Postdoctoral Research Fellow, Institut for Videnskabshistorie, Aarhus Universitet, Denmark, October 1–November 30, 2004): National dissemination of knowledge in the European periphery; Danish chemical periodicals in the nineteenth century.

Prof. Dr. Sergio Nobre (Visiting Scholar, Departamento de Matematica / UNESP, Rio Claro, Brazil, September 1, 2003–February 28, 2004): The German immigration in Brazil and its contribution for the education process.

Prof. Dr. Horst Nowacki (Visiting Scholar, Technische Universität Berlin, Germany, since August 2001): The relation between ship design and developments in fluid mechanics.

Prof. Dr. Mary Jo Nye (Visiting Scholar, Department of History, Oregon State University, Corvallis, USA, August 31–September 24, 2004): Michael Polanyi: A study in scientific life and the philosophy of science.

Prof. Dr. Robert Nye (Visiting Scholar, Department of History, Oregon State University, Corvallis, USA, August 31–September 24, 2004): Masculine culture in the modern scientific professions.

Prof. Dr. Francisco Javier Guerrero Ortega (Visiting Scholar, Deutscher Akademischer Austauschdienst, Universidade do Estado do Rio de Janeiro, Brazil, June 4–August 4, 2005): The "Cerebral Subject" in the popular culture of 19th and 20th centuries.

Prof. Dr. Laura Otis (Visiting Scholar, McArthur-Fellow, Department of English, Emory University, Atlanta, Georgia, USA, June 1, 2003–July 31, 2004 and June 17, 2005–August 15, 2006): Johannes Müller's role in 19th century physiology; laboratory dynamics; literature and science.

Dr. Dario Perinetti (Visiting Scholar, Social Sciences and Humanities Research Council of Canada, Département de philosophie, Université du Québec à Montréal, Québec, Canada, May 1–July 31, 2005): Philosophical Reflection on History in the Enlightenment.

Jahnavi Phalkey (Predoctoral Research Fellow, School of History, Technology and Society, Georgia Institute of Technology, Atlanta, USA, June 1–August 31, 2004): History of scientific instruments and practices in India, ca. 1930–1970.

Prof. Dr. Andrew Pickering (Visiting Scholar, University of Illinois at Urbana, Champaign, USA, November 1–December 12, 2004 and May 20–June 19, 2005): Science and technology studies, history of cybernetics.

Susanne Pickert (Predoctoral Research Fellow, Humboldt-Universität zu Berlin, January 1, 2004–August 15, 2006): Fossils during the middle ages (13th–15th century).

Prof. Dr. F. Jamil Ragep (Visiting Scholar, Department of the History of Science, The University of Oklahoma, USA, March 1–July 31, 2004): Research into the relation of science and religion in Islam.

Christina Ratmoko (Predoctoral Research Fellow, Forschungsstelle für Sozial- und Wirtschaftsgeschichte, Universität Zürich, Switzerland, March 15–June 30, 2005): The essence of femininity and masculinity: The making of sex hormons by ciba (Gesellschaft für Chemische Industrie Basel) and the therapeutic use from 1910 to 1940.

Dr. Sina Rauschenbach (Visiting Scholar, January 1–March 31, 2005): Menasse Ben Israel (1604–1657). Knowledge and intercultural exchange in 17th century judaism.

Sandra Rebok (Postdoctoral Research Fellow, Deutsche Forschungsgemeinschaft, Consejo Superior de Investigaciones Cientifícas, Spain, July 1–July 31, 2005): German travelers in the 19th century (Spain, Latin America, USA).

Dr. Maria Rentetzi (Visiting Scholar, National Technical University of Athens, Greece, May 15, 2003–February 29, 2004, June 15–August 14, 2004 and October 1–November 30, 2005): Gender and history of physics around 1900.

Dr. Ana Maria Ribeiro de Andrade (Visiting Scholar, Museu de Astronomia e Ciências Afins — MAST, Rio de Janeiro, Brazil, September 7–October 7, 2004 and September 19–October 17, 2005): Nuclear physics in Brazil.

Prof. Joan L. Richards (Visiting Scholar, History Department, Brown University, Providence, Rhode Island, USA, September 1–December 31, 2004 and August 15–August 28, 2005): Defining reason in the Frend/De Morgan household.

David Romand (Predoctoral Research Fellow, REHSEIS, Université Paris 7, France and Istituto di Fisiologia Umana, Università di Parma, Italy, July 1–July 31, 2004): History of the unconscious cognition (19–21th centuries).

Emmanuel Saadia (Predoctoral Research Fellow, The University of Chicago, Illinois, USA, October 20–December 20, 2004): The nature of capital: Agricultural science and political economy in revolutionary France.

Yaiza Santos Pérez (Visiting Scholar, Fundación Canaria Orotava de Historia de la Ciencia, La Orotava, Tenerife, Spain, October 1, 2003–March 31, 2004): Proyecto Humboldt.

Dr. Dagmar Schäfer (Postdoctoral Research Fellow, Sinologie, Kulturwissenschaften Ost- und Südasien, Julius-Maximilians-Universität Würzburg, Germany, September 5–November 30, 2005): China's ancient science and technology. Text-historical work on the Tiangong kaiwu and various other texts during the Ming dynasty (1368–1644).

Dr. Jutta Schickore (Visiting Scholar, Department of History and Philosophy of Science, University of Cambridge, UK, July 15–September 30, 2004 and May 12–June 30, 2005): The microscope and the eye, 1750–1850; the epistemic roles of error in scientific practice.

Dr. Mark Schiefsky (Visiting Scholar, Department of the Classics, Harvard University, Cambridge, Massachusetts, USA, September 1, 2003–August 31, 2004 and June 15–July 15, 2005): Project: Archimedes; History of mechanics in antiquity.

Dr. Albert Schirrmeister (Postdoctoral Research Fellow, Universität Bielefeld, Germany, March 1, 2004–August 31, 2005): Dreams and knoweldge in early modern societies.

Dr. Wolfgang Schivelbusch (Visiting Scholar, June 1–October 31, 2005): Use, consumption, metabolism (Stoffwechsel) in economic, physiological and technical nineteenth century thought.

Alexander von Schwerin (Postdoctoral Research Fellow, Abteilung für Geschichte der Naturwissenschaften, Technische Universität Braunschweig, Germany, March 1–August 31, 2004): Radioactivity and biological research in Germany, 1920–1970.

Prof. Dr. Mark Seltzer (Visiting Scholar, Department of English, University of California at Los Angeles, USA, May 1–July 31, 2004): True crime: investigation of forms of public violence and collective belief in modern culture.

Dr. Suman Seth (Postdoctoral Research Fellow, Department of History, Princeton University, New Jersey, USA, October 1, 2003–July 15, 2004): Practices of theoretical physics in Germany between 1890 and 1930.

Dana Simmons (Postdoctoral Research Fellow, University of Chicago, Illionois, USA, October 1, 2004–June 30, 2005): Minimal frenchmen: science and standards of living, 1840–1920.

Dr. Leo B. Slater (Visiting Scholar, John Hopkins School of Public Health, Baltimore, Maryland, USA, January 10–August 31, 2004): History of malaria chemotherapy in the twentieth century.

Katrin Solhdju (Predoctoral Research Fellow, January 1, 2004–December 31, 2006): Self-experimentation. Crossing the borders between science and art 1850–1920.

Dr. Anna Somfai (Visiting Scholar, The Warburg Institute, University of London, UK, January 17–March 16, 2005): The nature, role, and transmission of diagrams and diagrammatic images in early medieval (7th-12th c.), Manuscripts of philosophical, scientific, and encyclopaedic texts.

Andrew Sparling (Predoctoral Research Fellow, Duke University, Durham, North Carolina, USA, January 1–December 31, 2004): Johann Rudolph Glauber: Experience and authority in seventeenth-century alchemy.

Dr. Emma Chartreuse Spary (Visiting Scholar, University of Cambridge, UK, July 2 –July 30, 2005): History of natural history, medicine, chemistry in 18th-century France, Eating the enlightenment: Food and the sciences in France, 1675 to 1815.

Prof. Dr. Richard Staley (Visiting Scholar, Department of the History of Science, University of Wisconsin-Madison, Madison, USA, August 1, 2003–July 31, 2004): Material, conceptual and disciplinary foundations of physics in the period from 1870 to the 1920th.

Dr. Klaus Staubermann (Visiting Scholar, Universiteitsmuseum Utrecht, The Netherlands, July 1–August 31, 2004): Appropriating experimentation in museum databases.

Prof. Larry Stewart (Visiting Scholar, University of Saskatchewan, Department of History, Canada, November 1, 2003–February 29, 2004, February 10–February 26, 2005 and June 1–June 30, 2005): Physical science, medicine and industry in early modern Europe, 1770–1820.

Dr. Heiko Stoff (Postdoctoral Research Fellow, Abteilung für Geschichte der Naturwissenschaften, Technische Universität Braunschweig, Germany, March 1–August 31, 2004): Enzymes, hormones, vitamines. A history of active substances based on projects promoted by the Deutsche Forschungsgemeinschaft (1920–1970).

Daniel Stolzenberg (Postdoctoral Research Fellow, Department of History, Stanford University, California, USA, September 1, 2003–August 31, 2005): Antiquarianism, oriental studies and occult sciences in the seventeenth century: Athanasius Kircher, hieroglyphs, amulets (Project: Knowledge and Belief).

Thomas Sturm (Lorenz Krüger Postdoctoral Research Fellow, October 1, 2005–January 31, 2006): Perceptual illusions in the dynamics of psychological research; Rationality in philosophy and psychology; Kant's concept of science.

Dr. Edna Maria Suárez-Diaz (Visiting Scholar, Filosofía e Historia de la Biología, Facultad de Ciencias U.N.A.M., Ciudad de México, Mexico, August 1, 2005–July 31, 2007): Representation and the production of knowledge in molecular evolution.

Dr. Udo Volkmar Thiel (Visiting Scholar, Australian National University, Department of Philosophy, Australian National University, Canberra, Australia, October 5, 2004–January 28, 2005 and December 13, 2005–February 16, 2006): Self-conciousness and personal identity in eighteenth-century philosophy.

Dr. Olivier Thiery (Postdoctoral Research Fellow, Centre de Sociologie de L'Innovation Ecole Nationale Supérieure des Mines de Paris, France, October 1, 2004–September 30, 2006): Contemporary history and ethnology of neo-natal medicine and prematures babies' care.

Prof. Dr. Miao Tian (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, June 22–July 9, 2004, September 1–September 30, 2004 and September 26–November 30, 2005): History of mathematics. History of mechanics. (Project: Development of mechanical knowledge in China).

Dr. Margareta T. Tillberg (Visiting Scholar, Designavdelningen, Institutionen för teknik & design, Växjö universitet, Sweden, November 1, 2005–January 31, 2006): Observer and observed in design institutes in the Soviet 1960's.

Dr. Sacha Tomic (Visiting Scholar, Université Paris X—Nanterre, France, February 1–March 31, 2004): Plant chemical analysis at the beginning of the 19th century.

Dr. John Tresch (Visiting Scholar, University of Chicago, Illinois, USA, June 1–July 31, 2005): Mechanical romanticism: Technologies of social and natural reconstruction in France, 1815–1848.

Dr. Danny Trom (Visiting Scholar, Centre National de la Recherche Scientifique, Groupe de Sociologie Politique et Morale-EHESS, Paris, France, September 1, 2005–June 30, 2006): Seeing landscapes: The politics of nature in late 19th-century Germany.

Dr. Jeroen van Dongen (Postdoctoral Research Fellow, February 1, 2003–January 31, 2004): History of black hole theory.

Koen Vermeir (Predoctoral Research Fellow, Hoger instituut wijsbegeerte, Leuven, Katholieke Universiteit Leuven, The Netherlands, April 1–August 31, 2005): The powers of the imagination: Rationality and irrationality in early modern europe.

Jeremy Vetter (Postdoctoral Research Fellow, University of Pennsylvania, USA, September 1, 2005–August 31, 2007): Knowledge, environment, and field work in the American west in the 19th and 20th centuries.

Dr. Marga Vicedo-Castello (Postdoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, USA, September 1, 2005–June 30, 2006): A history of scientific theories of the maternal instinct.

Margarete Vöhringer (Predoctoral Research Fellow, VolkswagenStiftung, Humboldt-Universität zu Berlin, Germany, February 1, 2001–January 31, 2004): Psychotechnics and avantgarde: On the convergence of science, art and technology in the Russian twenties.

Julia Voss (Predoctoral Research Fellow, Volkswagenstiftung, Humboldt-Universität zu Berlin, February 1, 2001–January 31, 2004): Darwin's images.

Prof. Dr. Daniel Warren (Visiting Scholar, Department of Philosophy, University of California, Berkeley, USA, October 1, 2004–June 30, 2005): Kant and the natural sciences of the eighteenth century.

Prof. Dr. Andrew Warwick (Visiting Scholar, Imperial College of Science, Technology and Medicine, London, UK, August 21–September 19, 2004 and August 18–September 18, 2005): X-rays and changing perceptions of disease and the body in Germany circa 1900.

Prof. Dr. Eric Watkins (Visiting Scholar, Humboldt Stiftung, Department of Philosophy, University of California, San Diego, USA, July 1–August 31, 2004 and June 6–August 29, 2005): Editing Immanuel Kant's scientific writings for a volume of the Cambridge edition of the works of Immanuel Kant.

Prof. Dr. Simon Werrett (Visiting Scholar, University of Washington, Seattle, USA, July 1–July 31, 2005): Playing with fire: Pyrotechnics, artisanry and natural philosophy in early modern europe.

Dr. Christina Wessely (Postdoctoral Research Fellow, Historisch-Kulturwissenschaftliche Fakultät, Universität Wien, Austria, October 1, 2005–September 30, 2007): The 'Welteislehre' ('world ice theory')—Science, fiction and the public sphere 1894–1945.

Ashley West (Predoctoral Research Fellow, Center for Advanced Study in the Visual Arts (CASVA) Fellowship, Department of the History of Art, University of Pennsylvania, Philadelphia, USA, September 15, 2003–March 31, 2005): Visualizing knowledge: Prints and paintings by Hans Burgkmair the Elder (1473–1531) (Project: Knowledge and Belief).

Lambert Williams (Predoctoral Research Fellow, Department of the History of Science, Harvard University, Cambridge, Massachusetts, USA, September 1, 2004–June 30, 2006): Complexity, computation, and virtual experiment, 1960–2000.

Prof. Dr. Catherine Wilson (Visiting Scholar, Department of Philosophy, University of British Columbia, Vancouver, Canada, August 1–August 15, 2004): The revival of Epicurean materialism in seventeenth-century metaphysics, natural philosophy, and political and moral theory.

Prof. Dr. M. Norton Wise (Visiting Scholar, Department of History, University of California, Los Angeles, USA, August 6–September 29, 2004 and July 15–August 30, 2005): Bourgeois Berlin and laboratory science.

Dr. Barbara Wittmann (Visiting Scholar, Gerda Henkel Stiftung und IFK Wien, Universität Trier, Germany, November 1, 2003–October 31, 2005): Epistemic history of children's drawings, 1880–1930.

Prof. Dr. Gereon Wolters (Visiting Scholar, Universität Konstanz, Germany, September 1–October 15, 2004): Classification in Whewell.
Falk Wunderlich (Lorenz Krüger Postdoctoral Research Fellow, April 1, 2003–December 31, 2005): Theory of matter around 1800.

Dr. Yunhong Xiao (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, October 3–November 15, 2005): Development of Mechanical Knowledge in China.

Xiaodong Yin (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, June 10–July 10, 2004, September 16–November 15, 2004 and September 26–November 30, 2005): Development of mechanical knowledge in China and its interaction with other cultural traditions. The history of mechanics.

Dr. Gábor Áron Zemplén (Postdoctoral Research Fellow, Hungarian Academy of Science, Budapest, Hungary, January 1– September 10, 2005): Scientific debates around the modificationist theories of colour.

Prof. Dr. Baichun Zhang (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, June 11–July 10, 2004, September 8–November 15, 2004 and October 3–November 30, 2005): History of mechanics. History of technology. (Project: Development of mechanical knowledge in China).

Rafael Ziegler (Predoctoral Research Fellow, Department of Philosophy, McGill University, Montreal, Quebec, Canada, January 20–February 20, 2005 and September 1, 2005–June 30, 2006): Of telescopes and footprints—(sustainability) indicators, statistical observation and political perception.

Prof. Dr. Dahai Zou (Postdoctoral Research Fellow, Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China, September 16–November 15, 2004 and September 26–November 30, 2005): History of mathematics. History of mechanics. (Project: Development of mechanical knowledge in China).

Additional Collaborators of the Exhibition Project "Albert Einstein — Engineer of the Universe"

*Hartmut Amo*n (November 15, 2004–November 30, 2005): Image Editor.
Reiner Braun (July 1, 2004–December 31, 2005): Supporting Program.
Dr. Peter Carl (November 8, 2004–May 31, 2005): Einstein's World Today.
Wendy Coones (May 17, 2004–September 30, 2005): Media Pedagogics.

Carmen Hammer (May 1, 2004–July 31, 2006): Catalogue Editorial Staff.
Dr. Wolf-Dieter Mechler (June 1, 2004–March 31, 2005): Editorial Staff Albert Einstein – One Hundred Authors for Einstein.
Sandra Schmidt (April 1, 2004–December 31, 2005): Worldwide Film Research.
Ursula Schmidt (November 1, 2004–December 31, 2005): Public Relations.
Nicole Schuchardt (March 1, 2005–September 30, 2005): Public Relations.
Dr. Michael Schüring (July 1, 2004–June 30, 2005): Einstein—His Life's Path and Einstein's World Today.
Ekkehard Sieker (September 1, 2003–July 31, 2005): Supporting Program, Film Research.
Tanja Starkowski (January 15, 2005–November 30, 2005): Copyright Management.
Prof. Dr. Kurt Sundermeyer (March 1, 2005–September 30, 2005): Einstein's World Today.
Dr. Jörg Zaun (June 1, 2004–December 31, 2005): Einstein's World Today.

Collaboration and Other External Activities

Memberships

The Institute is member of the Verbund für Wissenschaftsgeschichte, the Agricola-Gesellschaft, the Gesellschaft für Wissenschaftsgeschichte and the Deutsche Gesellschaft für Geschichte der Medizin, Naturwissenschaft und Technik.

Professorships

Lorraine Daston is honorary professor at the Humboldt Universität zu Berlin,
Dieter Hoffmann is außerplanmäßiger Professor at the Humboldt Universität zu Berlin,
Wolfgang Lefèvre is außerplanmäßiger Professor at the Freie Universität Berlin,
Jürgen Renn is adjunct professor at Boston University and honorary professor at the Humboldt Universität zu Berlin,
Hans-Jörg Rheinberger is honorary professor at the Technische Universität Berlin.

Cooperation Partners

Albert Einstein Archives, Jerusalem, Israel
Archivio di Stato die Venezia, Italy
Arizona State University, U.S.A.
Berlin-Brandenburgische Akademie der Wissenschaften
Berliner Medizinhistorisches Museum

Collaboration partners of the MPIWG

Bibliotheca Hertziana—Max-Planck-Institut für Kunstgeschichte, Rome, Italy
British Museum, London, U.K.
Comenius Garten, Berlin
Department of Philosophy, University of Haifa, Israel
European Union and Partners of the ECHO-Project
Fakultät Medien, Bauhaus-Universität Weimar
Fundación Canaria Orotava de Historia de la Ciencia, Tenerife, Spain
Harvard University, Cambridge, U.S.A.
Hermann von Helmholtz-Zentrum für Kulturtechnik, Humboldt-Universität zu Berlin
Hermitage Museum St. Petersburg, Russia
Institut für Kunstgeschichte, Freie Universität Berlin
Institut für Vorderasiatische Altertumskunde, Freie Universität Berlin
Institut Pasteur, Paris, France
Institute for the History of Natural Sciences, Chinese Academy of Sciences, Beijing, China
Istituto e Museo di Storia della Scienca, Florence, Italy
London School of Economics, U.K.
L'Université catholique de Louvain, Brussels, Belgium
Max-Planck-Institut für Bildungsforschung, Berlin
Max-Planck-Institut für Kognitions- und Neurowissenschaften
Max-Planck-Institut für Psycholinguistik, Nijmegen, The Netherlands
Max-Planck-Institut zur Erforschung von Gemeinschaftsgütern, Bonn
MIT—Dibner Institute for the History of Science
Mongolian Academy of Science, Ulan Bator, Mongolia
Musée du Louvre, Paris, France
National and Kapodistrian University of Athens, Greece
Norwegian Institute of Palaeography and Historical Philology, Oslo, Norway
Opera di Santa Maria del Fiore, Florence, Italy
Partners of the exhibition project "Einstein – Ingenieur des Universums" Berlin 2005
Program for the History and Philosophy of Science at Stanford University
Staatsbibliothek zu Berlin (Stiftung Preußischer Kulturbesitz)
Stazione Zoologica Anton Dohrn, Naples, Italy

The Cohn Institute for the History and Philosophy of Science and Ideas,
Tel-Aviv University, Israel
Tufts University, Medford, U.S.A
Universidad Nacional Autónoma de Mèxico
Universidade do Estado do Rio de Janeiro, Brazil
Universität Bern, Switzerland
Universitè de Genève, Switzerland
Universiteitsmuseum Utrecht, The Netherlands
University of California at Los Angeles, U.S.A.
University of Chicago, U.S.A.
University of Exeter, U.K.
University of Missouri at Kansas City, U.S.A.
Vorderasiatisches Museum Berlin (Stiftung Preußischer Kulturbesitz)
Zentrum für Literaturforschung, Berlin

Partners of the International Max Planck Research Network "History of Scientific Objects"

Günter Abel, Technische Universität Berlin
Jochen Brüning, Humboldt Universität zu Berlin
Peter Galison, Harvard University, Cambridge, U.S.A.
Paolo Galluzzi, Istituto e Museo di Storia della Scienca, Florence, Italy
Friedrich Kittler, Humboldt Universität zu Berlin
Eberhard Knobloch, Technische Universität Berlin
Wolfgang Krohn, Universität Bielefeld
Peter Lipton, University of Cambridge, U.K.
Thomas Macho, Humboldt Universität zu Berlin
Everett Mendelsohn, Harvard University, Cambridge, U.S.A.
Dominique Pestre, Ecole des Hautes Etudes en Sciences Sociales, Paris, France
Claudio Pogliano, Università di Pisa, Consortium of Tuscan Universities, Italy
Allan Brandt, Harvard University, Cambridge, U.S.A.
Simon Schaffer, University of Cambridge, U.K.
Peter Weingart, Universität Bielefeld
Michael Hagner, ETH Zürich, Switzerland
Jakob Tanner, Universität Zürich, , Switzerland
Helmuth Trischler, Deutsches Museum, München

Editorships

Peter Damerow is co-editor of Materialien zu den frühen Schriftzeugnissen des Vorderen Orients (MSVO).
Lorraine Daston is consulting editor to Science in Context of Cambridge University Press, and member of the editorial board of the Revue d'Histoire des Sciences Humaines.

Dieter Hoffmann is member of the editorial board of Physics in Perspective.
Ursula Klein is member of the editorial board of Ambix and of Centaurus
Jürgen Renn is co-editor of Boston Studies in the Philosophy of Science; and of Science in Context, member of the editorial boards of Living Reviews in Relativity; Archimedes; Studies in History and Philosophy of Modern Physics; Automata: Nature, Science, and Technics in the Ancient World; and member of the advisory board of Galilaeana: Journal of Galilean Studies.
Hans-Jörg Rheinberger is advisory editor of ISIS; consulting editor of Studies in History and Philosophy of the Biological and Biomedical Sciences; member of the editorial boards of Annals of the History and Philosophy of Biology; History and Philosophy of the Life Sciences; Sociology of the Sciences Yearbook; Studies in Transformations in Art and Culture; member of the advisory boards of International Journal of History and Ethics of Natural Sciences, Technology and Medicine (NTM); Biological Theory; Handbook of Science and Technology (Society for Social Studies of Science); Representaciones; Gesnerus, Swiss Journal of the History of Medicine and Sciences; member of the scientific review board of Demographic Research.
Fernando Vidal is consulting editor of Revue d'Histoire des Sciences Humaines, History of Psychology, Cuadernos argentinos de historia de la psicología, Anuario de psicología, Studi di psicologia dell'educazione.

Teaching Activities

Winter 2003/04

Erna Fiorentini: "A new visible World discovered for the understanding" Robert Hooke's Micrographia (Seminar, Universität Augsburg)
Bettina Gockel: Paul Klee. Life and Work (Proseminar, Universität Tübingen)
Bettina Gockel: The Science of the Artist. 18th to 20th century (Hauptseminar, Universität Tübingen)
Christoph Hoffmann: Medizin und Literatur um 1900 (Seminar, Europa-Universität Viadrina Frakfurt/Oder)
Dieter Hoffmann: Max Planck (1858–1947): Wissenschaft und Gesellschaft im Spiegel einer Gelehrtenbiographie (Seminar, Humboldt Universität zu Berlin)
Horst Kant: Forschen unter Stalin und Hitler—Naturwisssenschaftler im Konflikt with der Macht (Hauptseminar, Freie Universität Berlin, with Jutta Petersdorf)
Bernhard Kleeberg: Theorien der Wissenschaftsgeschichte I (Seminar, Universität Konstanz, with Michael Kempe)
Wolfgang Lefèvre: Philosophie, Wissenschaft, Gesellschaft: Philosophie und Psychoanalyse (Forschungskolloquium, Freie Universität Berlin)
Sicco Lehmann-Brauns: Das klassische Völkerrecht (Seminar, Freie Universität Berlin)
Staffan Müller-Wille: Kulturgeschichte der Vererbung (Proseminar, Technische Universität Berlin, with Hans-Jörg Rheinberger)

Staffan Müller-Wille: Introduction to historical epistemology (Graduate Seminar, Universidad Nacional Autonoma de Mexico, Mexico City)
Albert Presas i Puig: Epistemology and history of Biology and Medicine (Seminar, University Pompeu Fabra, Barcelona)
H. Otto Sibum: Objekte der Wissensgeschichte (Seminar, Technische Universität Braunschweig)
Friedrich Steinle: Neue Beiträge zur Geschichte der Naturwissenschaften und Technik (Oberseminar, Universität Stuttgart)
Friedrich Steinle: Klassiker der Naturwissenschaften des 19. Jahrhunderts (Lektürekurs, Universität Stuttgart)
Friedrich Steinle: Geschichte der Naturwissenschaften IV: Das 19. Jahrhundert (Kursvorlesung, Universität Stuttgart)
Annette Vogt: Historiker(innen), Mathematiker(innen) und andere Gelehrte – Karrieremuster und Netzwerke (Proseminar, Humboldt Universität zu Berlin, with Peter Th. Walter)
Annette Vogt: Wissenschaftsbeziehungen zwischen Deutschland und Rußland / Sowjetunion im 19. und 20. Jahrhundert (Seminar, Freie Universität Berlin, with Jutta Petersdorf)

Sommer 2004

Charlotte Bigg: Einführung in die Wissenschaftsgeschichte (Lecture, ETH Zürich, Switzerland, Michael Hagner, Peter Geimer, Marianne Sommer)
Christina Brandt: Das Leben schreiben. Biowissenschaften und Literatur im 20. Jahrhundert (Seminar, Technische Universität Braunschweig)
Christina Brandt: 12. Studientag Wissenschaftsgeschichte (Kolloquium, MPIWG, with Bernhard Kleeberg)
Mechthild Fend: Das Inkarnat. die Körperoberfläche als maltechnisches und kunsttheoretisches Problem (Seminar, Humboldt Universität zu Berlin)
Bernhard Kleeberg: 12. Studientag Wissenschaftsgeschichte (Kolloquium, MPIWG, with Christina Brandt)
Staffan Müller-Wille: Genes and species, class and race: Towards a social history of classification (Lecture and postgraduate seminar, Tel Aviv University)
H. Otto Sibum: Wunderkammern, Museen, Weltausstellungen (Seminar, Technische Universität Braunschweig)
Friedrich Steinle: Geschichte der Naturwissenschaften V: Das 20. Jahrhundert (Kursvorlesung, Universität Stuttgart)
Friedrich Steinle: Klassiker der Naturwissenschaften des 20. Jahrhunderts (Lektürekurs, Universität Stuttgart)
Friedrich Steinle: Experimentalwissenschaften im 18. Jahrhundert (Hauptseminar, Universität Stuttgart)
Annette Vogt: Heimkehr in die Fremde? - RemigrantInnen nach Ost- und Westdeutschland (Proseminar, Humboldt Universität zu Berlin, with Peter Th. Walter)

Winter 2004/05

Charlotte Bigg: Science Fiction (Seminar, ETH Zürich, Switzerland, with Peter Geimer)
Christina Brandt: Geschichte der Biowissenschaften und Biotechnologie im 20. Jahrhundert, Teil I (Blockseminar, Technische Universität Braunschweig)
Christina Brandt: 13. Studientag Wissenschaftsgeschichte (Kolloquium, MPIWG, with Bernhard Kleeberg)
Uljana Feest: Erklären und Verstehen aus historischer und philosophischer Sicht (Proseminar, Freie Universität Berlin)
Bernhard Kleeberg: Theorien der Wissenschaftgeschichte II (Seminar, Universität Konstanz, with Michael Kempe)
Bernhard Kleeberg: 13. Studientag Wissenschaftsgeschichte (Kolloquium, MPIWG, with Christina Brandt)
Ursula Klein: Geschichte der experimentellen Wissenschaften I (17. und 18. JH) (Kompaktseminar, Universität Konstanz)
Annette Vogt: Wissenschaftsbeziehungen zwischen Deutschland und Rußland/Sowjetunion im 19. und 20. Jahrhundert (Hauptseminar, Freie Universität Berlin, with Jutta Petersdorf)

Hosted Scholars

The institutions listed below funded 29 scholars in 2004 and 42 scholars in 2005. The average duration of their stay was 6 months.

Alexander-von-Humboldt-Stiftung
Australian National University
Australian Research Council
Brandeis University
CAPES (Brazilian agency for the advanced training of university personnel)
Center for Advanced Study in the Visual Arts (CASVA)
Centre National de la Recherche Scientifique
Columbia University
Consejo Superior de Investigaciones Scientificas
Deutsche Forschungsgemeinschaft
Deutscher Akademischer Austauschdienst
ETH Zurich, Switzerland
Fondation Treilles
Fritz-Thyssen-Stiftung
Fulbright Program
Gerda Henkel Stiftung
German-Israeli Foundation for Scientific Research and Development (GIF)
IFK Wien
Korea Science and Engineering Foundation
Liechtenstein Fonds for the History of Science

McArthur Foundation
Minerva Foundation
Oklahoma University
Princeton University
Social Sciences and Humanities Research Council of Canada
The Bank of Sweden Tercentenary Foundation
The Wellcome Trust
Universität Bremen
Universität Zürich
Université catholique de Louvain
Université Nancy 2
University of British Columbia
University of California
University of Cambridge
University of Chicago
University of Maastricht
University of Manchester
University of Oslo
University of Oxford
University of Toronto
VolkswagenStiftung

Conferences, Workshops, and Colloquia

Workshops and Conferences

6 February and 25 June 2004, 28 January and 15 July 2005: Zwischenräume: Seriality; Vitalism/Mortalism; Figures of Isolation; Infection and Immunity. Four workshops organized together with the Helmholtz-Zentrum für Kulturtechnik and the Zentrum für Literaturforschung, Berlin
7 February 2004: Intellectual Work as Labor. Co-organized with M. Norton Wise and held at the University of California Los Angeles (UCLA)
1–4 April 2004: Discovery and Justification. Book workshop organized by Jutta Schickore and Friedrich Steinle
17 April 2004: 11. Studientag Wissenschaftsgeschichte
19–20 April 2004: Final conference of the project "European Cultural Heritage Online" (ECHO)
6–8 May 2004: Im Reich der Dinge. Das Museum als Erkenntnisort. Conference. Deutsches Hygiene-Museum Dresden in cooperation with the MPIWG
25–27 May 2004 and 1–3 July 2004: Workshops of the project "Knowledge and Belief"

10–16 June 2004: Regulation. Historical and Current Themes in Theoretical Biology. Joint workshop of the Collaborative Research Center for Theoretical Biology (SFB 618) and MPIWG
1–3 July 2004: Husserl and the Historical Epistemology of Sciences. MPIWG with participation of the University of Ottawa
16–17 August 2004: Zur Kritik des mechanischen Weltbildes – Kant, Hegel, Marx und die Folgen. Konferenz zu Ehren von Renate Wahsners 65. Geburtstag
17–26 August 2004: Berlin Summer Academy "Science on Screen"
23 October 2004: 12. Studientag Wissenschaftsgeschichte
29–30 October 2004: Miracles as Epistemic Things
11–14 November 2004: New Paths of Physical Knowledge. Science and the Changing Sense of Reality circa 1900
12–13 November 2004: Epistemologie der Aufzeichnungsapparate. Von der Hämodynamik zur Medienphysik
25–26 November 2004: Bauplanung, Arbeitsorganisation und Bautechnik in den frühen Hochkulturen
10–11 December 2004: The Making of Materials
13–16 January 2005: A Cultural History of Heredity III: Nineteenth and Early Twentieth Centuries
13–15 January 2005: Before the Revolutions: Religions, Sciences and Politics in the Fifteenth Century. Conference organized by Rivka Feldhay (Tel Aviv University, Israel), Jamil Ragep (University of Oklahoma, U.S.A.), Wilhelm Schmidt-Biggemann (Freie Universität Berlin, Germany)
28–29 January 2005: Observing Nature—Representing Experience. Workshop organized by Erna Fiorentini (Freie Universität Berlin/MPIWG)
6–13 March 2005, La Orotava, Tenerife: Einstein and the Changing World Views of Physics, 1905/2005 HGR7. Seventh International Conference on the History of General Relativity, jointly organized with la Fundación Canaria Orotava de Historia de la Ciencia and el Instituto de Atrofisica de Canarias
10–12 March 2005: Labor und Seminar. Berliner Kulturräume der Wissenschaften im 19. Jahrundert. Conference jointly organized with the Institute for the History of Medicine of the Charité Berlin
16 April 2005: 13. Studientag Wissenschaftsgeschichte
8–10 May 2005: Error in Experimental Science. Workshop at the University of Haifa jointly organized with the MPIWG
27 May 2005: Der geometrische Entwurf der Hagia Sophia in Istabul. Workshop
2–5 June 2005: The Shape of Experiment. Conference organized by the project "Experimentalization of Life"
12–15 June: Borderline Problems of Science 1905 and 2005. Celebratory colloquium organized on behalf of the MPG at the Berlin Urania Congress Center
1–2 July 2005: Gespenster und Politik in Europa, 16.–21. Jahrhundert. Conference organized by Claire Gantet et Fabrice d' Almeida (Centre Marc Bloch, Berlin) funded by the Fritz-Thyssen-Stiftung
7–8 July 2005: Discovery, Creativity and Innovation. Einstein's annus mirabilis. Conference at the University of Bern jointly organized with the MPIWG

24–26 August 2005: The Destruction of Biblical Chronology between Scaliger and Vico Workshop in collaboration with the Department of History, Princeton University and the Andrew W. Mellon Foundation
12–14 October 2005: Observation in the Enlightenment, jointly organized with the Niedersächsische Staats- und Universitätsbibliothek Göttingen
13–15 October 2005: History and Epistemology of Molecular Biology and Beyond: Problems and Perspectives. Conference jointly organized with Institut Pasteur, Fondation Mérieux, and Société d'histoire et d'épistémologie des sciences de la vie.
22 October 2005: 14. Studientag Wissenschaftsgeschichte
2 December 2005: The Century of the Gene. Workshop at the University of Exeter jointly organized with the MPIWG
12 December 2005: Einstein and Europe. Conference at the Wissenschaftszentrum Nordrhein-Westfalen jointly organized with the Royal Netherlands Academy of Arts and Sciences and the MPIWG
14–15 December 2005: Travelling Facts. Workshop jointly organized with the London School of Economics
16–17 December 2005: Between economics and biology: Organisms and metabolism in the nineteenth and twentieth centuries jointly organized with Abigail Lustig, University of Texas at Austin, USA

The Institute's Colloquia

18 February 2004 *Manfred Laubichler* Ernst Cassirer and Theoretical Biology
3 March 2004 *Alexandre Métraux* Animal Hypnotism
24 March 2004 *Dominique Pestre* The Production and Regulation of the Sciences in Society Today
12 May 2004 *Domenico Bertoloni-Meli* The Medical Assayer of Marcello Malpighi
26 May 2004 *Mechthild Fend* Das Haptische bei Alois Riegl. Raumwahrnehmung und Bildbetrachtung um 1900
9 June 2004 *Andreas Kleinert* Lenard und Stark im Dritten Reich. Der Briefwechsel der beiden Physiker aus den Jahren 1933–1947
7 July 2004 *Rüdiger Campe* Evidence as Device, 1650–1790. A Concept of Cultural Analysis
21 July 2004 *Doris Kaufmann* "Primitivismus": Zur Geschichte eines semantischen Feldes, 1900–1930
4 August 2004 *Leoncio López-Ocón* The 'processionary science' of the Comisión Científica del Pacífico, a symbol of the discontinuity of science in Spain
1 September 2004 *Lorraine Daston*, *Fernando Vidal* Book presentation The Moral Authority of Nature
15 September 2004 *Robert Nye* Methods and Theory in the History of Masculinity
29 September 2004 *Antoni Malet* Science in Francoist Spain (1939–1967): 'scientific isolation' revisited
10 November 2004 *Anke te Heesen, Lorraine Daston* Book presentation Things that Talk

24 November 2004 *Wolfgang Lefèvre* Book presentaion Picturing machines: 1400–1700
8 December 2004 *Jonathan Lamb* Extreme and Sentimental History
26 January 2005 *Catherine Wilson* Epicurean Naturalism in Early Modernity: Some Texts and Problems
9 February 2005 *Pasi Falk* Tool-making and Taxonomies—some primal scene speculations
23 February 2005 *Tom Mitchell* Picturing Terror: Derrida's Autoimmunity
9 March 2005 *Moritz Epple* Singularities, knots, and mathematical modernism: On the transformation of the epistemic things of mathematics after 1900
6 April 2005 *Christina Brandt* Book presentation Metapher und Experiment: Von der Virusforschung zum genetischen Code
18 May 2005 *Gérard Jorland* What is a statistical observation? A case study
1 June 2005 *Soraya de Chadarevian* Models—The Third Dimension of Science
29 June 2005 *Hermann Schlimme* Zwischen Bautechnik und Naturwissenschaft: Eine unbekannte Florentiner Akademie des 17. Jahrhunderts
10 August 2005 *John Beckman* Distance as the key physical parameter in cosmology

Academic Achievements and Scientific Awards

Habilitations

Christoph Hoffmann received his *venia legendi* in Neuere Deutsche Literatur from the Europa-Universität Viardrina, Frankfurt/Oder, Germany in June 2004.
Sven Dierig received his *venia legendi* in Geschichte der Naturwissenschaften from the Technische Universität Berlin, Germany in January 2005.

PhD Theses

Jan Altmann completed his thesis on "Exakte Beobachtung der Natur und des Menschen" and was awarded his PhD by the Humboldt Universität zu Berlin, Germany in August 2005.
Katja Bödeker completed her thesis on "Die Entwicklung intuitiven physikalischen Denkens im Kulturvergleich" and was awarded her PhD by the Freie Universität Berlin, Germany in December 2004.
Deborah Rachel Coen, Predoctoral Research Fellow 2001/02, completed her thesis on "A Scientific Dynasty: Probability, Liberalism, and the Exner Family in Imperial Austria" and was awarded her PhD by the Dept. of the History of Science, Harvard University, Cambridge, Massachuchetts, U.S.A. in June 2004.
Thomas O. Haakenson completed his thesis on "Grotesque Visions: Art, Science, and Visual Culture in Early-Twentieth-Century Germany" and was awarded his PhD by the Department of Cultural Studies and Comparative Literature, University of Minnesota, Twin Cities, U.S.A. in July 2006.

Naomi Hume, Predoctoral Research Fellow 2002,completed her thesis on "Contested Cubisms: Transformations of the Czech Avant-Garde, 1910–1914" and was awarded her PhD by the University of Chicago, Illinois, U.S.A. in June 2004.
Anna Maerker completed her thesis on "Model experts: The production and uses of anatomical models at La Specola, Florence, and the Josephinum, Vienna, 1775–1814" and was awarded her PhD by the Department of Science and Technology Studies, Cornell University, Ithaca, New York, U.S.A. in August 2005.
Matthew Stanley, Predoctoral Research Fellow 2001/02, completed his thesis on "Practical Mystic: Religion and Science in the Life and Work of A. S. Eddington" and was awarded his PhD by the Harvard University, Cambridge, Massachuchetts, U.S.A. in June 2004.
Margarete Vöhringer completed her thesis on "Avantgarde und Psychotechnik. Wissenschaft, Kunst und Technik der Wahrnehmungsexperimente im post-revolutionärem Rußland" and was awarded her PhD by the Humboldt-Universität zu Berlin, Germany in February 2006.
Julia Voss completed her thesis on "Darwins Bilder. Ansichten der Evolutionstheorie 1837 bis 1874" and was awarded her PhD by the Humboldt-Universität zu Berlin, Germany in December 2005.
The dissertation of *Julia Voss* was awarded the Otto Hahn Medal 2005 by the Max Planck Society.
The dissertation of *Christina Brandt* "Metapher und Experiment. Von der Virusforschung zum genetischen Code" (completed 2002) was awarded the "Förderpreis der Deutschen Gesellschaft für Geschichte der Medizin, Naturwissenschaften und Technik (2005).

Appointments

Tara Abraham (Postdoctoral Research Fellow October 2002–June 2004) was appointed as Assistant Professor at the York University, Toronto, Canada.
Nancy Anderson (Rathenau Postdoctoral Research Fellow October 2002–September 2004) was appointed as Assistant Professor at the State University of New York, Buffalo, U.S.A.
Monika Baár (Postdoctoral Research Fellow September 2003–August 2005) was appointed as Teaching Fellow at the Department of History, University of Essex, U.K.
Naomi Beck (Predoctoral Research Fellow October 2004–July 2005) was appointed as Assistant Professor at the Social Sciences Collegiate Division, Society of Fellows, The University of Chicago, Illinois, U.S.A.
Elena Bougleux (Visiting Scholar September–November 2004) was appointed as Researcher at the Research Centre on the Anthropology and the Epistemology of Complexity.
Claudia Bührig (Research Scholar November 2002–May 2005) was appointed as Wissenschaftliche Mitarbeiterin at the Deutsches Archäologisches Institut, Berlin, Germany.

Sven Dierig (Research Scholar July 1997–March 2006) was appointed as Manager of Science Communication at the Institut für Nanotechnologie, Forschungszentrum Karlsruhe GmbH, Germany.
Jeroen van Dongen (Postdoctoral Research Fellow February 2003–January 2004) was appointed as VENI Research Fellow of the Netherlands Organistation for Scientific Research at the Utrecht University, The Netherlands.
Philipp Felsch (Predoctoral Research Fellow February 2002–January 2005) was appointed as Postdoctoral Fellow at the ETH Zürich, Switzerland.
Mechthild Fend (Research Scholar September 2001–August 2004) was appointed as Lecturer at the Department of History of Art, University College London, U.K.
Christian Forstner (Predoctoral Research Fellow May–July 2005) was appointed as Gastwissenschaftler at the Institut für Zeitgeschichte, Universität Wien, Österreich.
Claire Gantet (Postdoctoral Research Fellow September 2003–August 2005) was appointed as Forschungsstipendiatin at the Historisches Kolleg, München, Germany.
Delphine Gardey (Alexander-v.-Humboldt-Stiftung Fellow September 2003–August 2004) was appointed as Chargée de recherche at the Centre de Recherche en Histoire des Sciences et des Techniques, Paris, France.
Peter Geimer (Research Scholar March 2001–March 2004) was appointed as Research Scholar at the ETH Zürich, Switzerland.
Birgit Griesecke (Postdoctoral Research Fellow September–December 2005) was appointed as Wissenschaftliche Mitarbeiterin at the Emmy-Noether-Nachwuchsgruppe "Kulturgeschichte des Menschenversuchs", Germanistisches Seminar, Universität Bonn, Germany.
Thomas O. Haakenson (Visiting Scholar September 2002–July 2004) was appointed as Lecturer at the Department of Cultural Studies and Comperative Literature, University of Minesota, Twin Cities, U.S.A.
Sarah Tindal Kareem (Postdoctoral Research Fellow August 2003–January 2004) was appointed as Harper Fellow and Collegiate Assistant Professor at the University of Chicago, Illinois, U.S.A.
Alexei Kojevnikov (Visiting Scholar June–July 2004) was appointed as Senior Research Associate at the Institute for the History of Science and Technology, Russian Academy of Sciences, Moscow, Russia.
Sachiko Kusukawa (Visiting Scholar October–November 2004) was appointed as Tutor and Fellow at the Trinity College, Cambridge, U.S.A.
Sofie Lachapelle (Postdoctoral Research Fellow June–August 2005) was appointed as Assistant Professor at the University of Guelph, Ontario, Canada.
Sicco Lehmann-Brauns (Postdoctoral Research Fellow September 2003–August 2005) was appointed as Referent und Vorstand at the Forschungsverbund Berlin e.V., Germany.
Laurent Loty (Visiting Scholar January–January 2004) was appointed as Maître de Conférences en Littérature Francaise at the Université Rennes 2, France.
Abigail Lustig (Rathenau Postdoctoral Research Fellow August 2003–August 2004) was appointed as Assistant Professor at the Department of History, University of Texas, Austin, U.S.A.
Jennifer Anne Marie (Karl Schädler Postdoctoral Research Fellow April 2004–September 2005) was appointed as Teaching Fellow at the Centre for the

Advancement of Learning and Teaching, University College London, U.K.
Amos Morris-Reich (Postdoctoral Research Fellow September–October 2005) was appointed as Kreitman Postdoctoral Research Fellow at the Department of Jewish Thought, Ben Gurion University, Beer-Sheva, Israel.
Kathrin Müller (Predoctoral Research Fellow October 2003–June 2005) was appointed as Wissenschaftliche Assistentin at the Art History Institute in Florence—Max Planck Institute, Italy.
Staffan Müller-Wille (Research Scholar December 2000–September 2004) was appointed as Senior Research Fellow at the ESRC Centre for Genomics in Society (Egenis), University of Exeter, U.K.
Jahnavi Phalkey (Predoctoral Research Fellow June–August 2004) was appointed as Doctoral Candidate at the School of History, Technology and Society, Georgia Institute of Technology, Atlanta, U.S.A.
Sina Rauschenbach (Visiting Scholar January–March 2005) was appointed as Wissenschaftliche Mitarbeiterin at the Institut für Geschichte, Martin-Luther-Universität Halle-Wittenberg, Germany.
Olivier Remaud (Alexander-v.-Humboldt-Stiftung Fellow April–December 2003) was appointed as Maître de Conférences at the École des Hautes Études en Sciences Sociales, Paris, France.
Jutta Schickore (Visiting Scholar May–June 2005) was appointed as Assistant Professor at the Indiana University, Bloomington, U.S.A.
Mark Schiefsky (Visiting Scholar June–July 2005) was appointed as Assistant Professor at the Department of the Classics, Harvard University, Cambridge, Massachusetts, U.S.A.
Albert Schirrmeister (Postdoctoral Research Fellow March 2004–August 2005) was appointed as Wissenschaftlicher Mitarbeiter at the Humboldt-Universität zu Berlin, Germany.
Markus Schnöpf (Research Scholar and Predoctoral Research Fellow until February 2005) was appointed as Wissenschaftlicher Mitarbeiter at the Berlin-Brandenburgische Akademie der Wissenschaften, Germany.
Suman Seth (Visiting Scholar October 2003–July 2004) was appointed as Assistant Professor at the Cornell University, Ithaca, U.S.A.
Dana Simmons (Postdoctoral Research Fellow October 2004–June 2005) was appointed as Assistant Professor at the University of California, Riverside, U.S.A.
Anna Somfai (Visiting Scholar January–March 2005) was appointed as Fellow and Visiting Professor at the Collegium Budapest and Department of Medieval Studies, Central European University, Budapest, Hungary.
Heiko Stoff (Postdoctoral Research Fellow March–August 2004) was appointed as Research Fellow at the Abteilung für Geschichte der Naturwissenschaften mit Schwerpunkt Pharmaziegeschichte, Technische Universität Braunschweig, Germany.
Daniel Stolzenberg (Postdoctoral Research Fellow September 2003–August 2005) was appointed as Assistant Professor/Post Doctorial Scholar at the History Department, University of Michigan, Ann Arbor, U.S.A.
John Tresch (Visiting Scholar June–July 2005) was appointed as Assistant Professor at the Pennsylvania University, Philadelphia, U.S.A.
Koen Vermeir (Predoctoral Research Fellow April–August 2005) was appointed as

Frank Boas Postdoctoral Fellow at the Department of the History of Science, Harvard University, Cambridge, Massachusetts, U.S.A.
Margarete Vöhringer (Predoctoral Research Fellow February 2001–January 2004) was appointed as Research Scholar at the Bauhaus Universität Weimar, Germany.
Alexander von Schwerin (Postdoctoral Research Fellow March–August 2004) was appointed as Research Fellow at the Abteilung für Geschichte der Naturwissenschaften mit Schwerpunkt Pharmaziegeschichte, Technische Universität Braunschweig, Germany.
Ashley West (Visiting Scholar September 2003–March 2005) was appointed as David E. Finley Fellow (CASVA) at the Department of the History of Art, University of Pennsylvania, Philadelphia, U.S.A.
Jessica Wilson (Visiting Scholar June–July 2005) was appointed as Assistant Professor at the University of Toronto, Canada.
Joseph Ziegler (Visiting Scholar January–February 2005) was appointed as Senior Lecturer at the Department of General History University of Haifa, Israel.

Publications

This bibliography comprises the publications of the Institute's members and guests during the period 2004–2005. Book reviews are not listed. Bibliography editors: Sabine Bertram and Anke Pietzke. Last update: August 23, 2006

Abattouy, Mohamed. "[Entries] 'Ibn al-Banna al-Murrakushi', 'Khazini, Abd al-Rahman al-K.'" In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Abraham, Tara. "Nicolas Rashevsky's mathematical biophysics." *Journal of the History of Biology* 37 (2 2004): 333–385.

Algazi, Gadi. "(In Hebrew) 'For this boy I prayed': Konrad Pellikan and the making of scholarly families in Northern Europe." *Historia* 14 (2004): 7–48.

Algazi, Gadi. "(In Hebrew) Listening to the voice which says No." In *(In Hebrew) The Refuseniks' Trials*, ed. Dov Hanin. 11–35. Tel Aviv: Babel Publishing House, 2004.

Algazi, Gadi. "Diversity rules: Peregrine Horden and Nicholas Purcell's 'The corrupting sea'. Essay review of: Horden, Peregrine and Nicholas Purcell: The corrupting sea: a study of Mediterranean history. Oxford: Blackwell 2000." *Mediterranean Historical Review* 20 (2 2005): 227–245.

Algazi, Gadi. "'Geistesabwesenheit': Gelehrte zu Hause um 1500." *Historische Anthropologie* 13 (3 2005): 325–342.

Aubin, David. "Forms of explanation in the catastrophe theory of René Thom: topology, morphogenesis, and the structuralism." In *Growing explanations: historical perspectives on recent science*, ed. M. Norton Wise. 95–130. Durham, NC [u. a.]: Duke Univ. Press, 2004.

Aubin, David. "Harold Scott MacDonald Coxeter." *Universalia* (2004): 435–436.

Aubin, David. "Quelques tendances actuelles en histoire des mathématiques. A propos de trois livres récents." *Gazette des Mathématiciens* 102 (2004): 91–100.

Aubin, David. "Un passage de Vénus en politique." La Recherche: *Revue Mensuelle*; Hors Série 15 (2004): 85–89.

1 2 3 4

Aubin, David. "Astronomical precision in the laboratory: the role of observatory techniques in the history of the physical sciences." In *Grundsätze über die Anlage neuer Sternwarten unter Beziehung auf die Sternwarte der Universität Göttingen von Georg Heinrich Borheck*, ed. Klaus Beuermann. 31–36. Göttingen: Universitätsverlag Göttingen, 2005.

Aubin, David. "George David Birkhoff 'Dynamical systems (1927)'." In *Landmark writings in western mathematics*, 1640–1940, ed. Ivor Grattan-Guinness. 871–881. Amsterdam: Elsevier, 2005.

Aubin, David. "Shiing-Shen Chern [Chen Xinshen], 1911–2004." In *Universalia* (2005): 431.

1 Azzouni, Safia. *Kunst als praktische Wissenschaft: Goethes 'Wilhelm Meisters Wanderjahre' und die Hefte 'Zur Morphologie'*. Köln [u. a.]: Böhlau, 2005.

Baader, Gerhard, Susan E. Lederer, Morris Low, Florian Schmaltz, and Alexander von Schwerin. "Pathways to human experimentation, 1933–1945: Germany, Japan, and the United States." *Osiris* 20 (2005): 205–231.

2 Badino, Massimiliano, ed. *Ludwig Boltzmann: fisica e probabilità*. Milano: Melquìades, 2005.

Badino, Massimiliano. "Ludwig Boltzmann e l'alba della probabilità in fisica." In *Ludwig Boltzmann: fisica e probabilità*, ed. Massimiliano Badino. 11–100. Milano: Melquìades, 2005.

Banks, Erik C. "Kant, Herbart and Riemann." Kant-Studien 96 (2 2005): 208–234.

Becchi, Antonio. *Q. XVI. Leonardo, Galileo e il caso Baldi: Magonza, 26 marzo 1621*. Venezia: Marsilio, 2004.

Becchi, Antonio. "88317.63520 Tarli della storia, piatti di lenticchie e vecchie zie." In *Teoria e pratica del costruire: saperi, strumenti, modelli; esperienze didattiche e di ricerca a confronto; seminario internazionale, Ravenna 27–29 ottobre 2005 = Theory and practice of construction: knowledge, means, models. Vol. I*, ed. Giovanni Mochi. 57–62. Ravenna: Ed. Moderna, 2005.

Becchi, Antonio. "[Entry] 'Baustatik'." In *Enzyklopädie der Neuzeit. Bd. 1*, ed. Friedrich Jaeger. 1093–1100. Stuttgart [u. a.]: Metzler, 2005.

Becchi, Antonio. "Fortuna (e sfortuna) critica del 'De re aedificatoria' di Bernardino Baldi." In *Bernardino Baldi (1553-1617) studioso rinascimentale: poesia, storia, linguistica, meccanica, architettura*, ed. Elio Nenci. 303–316. Milano: Angeli, 2005.

Becchi, Antonio. "Raisons a-symétriques. Équilibre des formes et formes de l'équilibre dans la 'theoria columnarum'." In *Symétries: contributions au séminare de Han-sur-Lesse, septembre 2002*, ed. Patricia Radelet-de Grave. 35–61. Turnhout: Brepols, 2005.

Becchi, Antonio. "Vaults in the air: Signor Fabritio's English theory." In *Essays in the history of the theory of structures: in honour of Jacques Heyman*, ed. Santiago Huerta. 45–59. Madrid: CEHOPU [u. a.], 2005.

3 Becchi, Antonio, Massimo Corradi, Federico Foce, and Orietta Pedemonte, eds. *Construction history: research perspectives in Europe*. Between mechanics and architecture; 6. Firenze: Williams, 2004.

Beck, Naomi. "Enrico Ferri's scientific socialism: A marxist interpretation of Herbert Spencer's organic analogy." *Journal of the History of Biology* 38 (2 2005): 301–325.

Berz, Peter and Christoph Hoffmann. "[Entry] 'Salcher, Peter'." In *Neue Deutsche Biographie. Bd. 22*, ed. Historische Kommission der Bayerischen Akademie der Wissenschaften. 364–365. Berlin: Duncker & Humblot, 2005.

Beurton, Peter. "[Entries] 'Tschetwerikow''Wawilow'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Beurton, Peter. "Genbegriffe." In *Philosophie der Biologie: eine Einführung*, eds. Ulrich Krohs and Georg Toepfer. 195–211. Frankfurt am Main: Suhrkamp, 2005.

4 Bevilacqua, Fabio and Jürgen Renn, eds. *Albert Einstein: ingegnere dell'universo*. Milano: Skira, 2005.

Bigg, Charlotte. "Spectroscopic metrologies." Nuncius 18 (2 2003 (publ. 2004)): 765–777.

Bigg, Charlotte. "Brownian motion." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 120–123. Weinheim: Wiley-VCH, 2005.

Bigg, Charlotte. "Das Panorama, oder la nature a coup d'oeil." *Nach Feierabend: Zürcher Jahrbuch für Wissensgeschichte* 1 (2005): 15–33.

Bigg, Charlotte. "Die Brownsche Bewegung." In *Albert Einstein–Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 120–123. Weinheim: Wiley-VCH, 2005.

Bigg, Charlotte. "Il moto browniano." In *Albert Einstein: ingegnere dell'universo*, eds. Fabio Bevilacqua and Jürgen Renn. 272–275. Milano: Skira, 2005.

Bigg, Charlotte. "L'optique de précision et la première guerre mondiale." *Schweizerische Zeitschrift für Geschichte* 55 (2005): 34–45.

Bigg, Charlotte and Klaus Staubermann. "Introduction to 'Spectroscope histories part II'." *Nuncius* 18 (2 2003 (publ. 2004)): 737–739.

Bigg, Charlotte and Klaus Staubermann. "Spectroscope histories part II." *Nuncius 18* (2 2003 (publ. 2004)): 735–852.

Bloor, David. "Toward a sociology of epistemic things." *Perspectives on Science* 13 (3 2005): 285–312.

Bödeker, Katja *see also: Gruber and Bödeker*

Bödeker, Katja. "Leere und Löcher." In Künstler, Wissenschaftler, Kinder und das Nichts: ein Werkstattbericht, eds. Jürgen Renn and Henning Vierck. 60–73. Berlin: Comenius-Garten, 2004.

Bödeker, Katja. "Luft. Nichts oder Etwas?" In *Künstler, Wissenschaftler, Kinder und das Nichts: ein Werkstattbericht,* eds. Jürgen Renn and Henning Vierck. 46–59. Berlin: Comenius-Garten, 2004.

Bödeker, Katja. "Time in the embryonic stage." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 38–43. Weinheim: Wiley-VCH, 2005.

Bödeker, Katja. "Zeit im Embryonalstadium." *In Albert Einstein—Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 38–43. Weinheim: Wiley-VCH, 2005.

Borck, Cornelius, Volker Hess, and Henning Schmidgen. "Einleitung." In *Maß und Eigensinn: Studien im Anschluß an Georges Canguilhem*, eds. Cornelius Borck, Volker Hess, and Henning Schmidgen. 7–41. München: Fink, 2005.

Borck, Cornelius, Volker Hess, and Henning Schmidgen, eds. *Maß und Eigensinn: Studien im Anschluß an Georges Canguilhem*. München: Fink, 2005.

1

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Die Natur technisch denken? Zur Synthese von 'téchne' und 'physis' in der Newtonschen Mechanik oder das Verhältnis von praktischer und theoretischer Mechanik in Newtons Physik." *Wiener Jahrbuch für Philosophie* 35 (2003 (publ. 2004)): 135–168.

Borzeszkowski, Horst-Heino v. and Renate Wahsner. "Infinitesimalkalkül und neuzeitlicher Bewegungsbegriff oder Prozeß als Größe." In *Jahrbuch für Hegelforschung 2002/2003*, ed. Helmut Schneider. 197–271. Sankt Augustin: Academia Verlag, 2004.

Bourguet, Marie-Noëlle. "Measurable difference: botany, climate and the Gardener's thermometer in eighteenth-century France." In *Colonial botany: science, commerce, and politics in the early modern world*, eds. Londa Schiebinger and Claudia Swan. 270–286. Philadelphia: Univ. of Pennsylvania Press, 2005.

Brandt, Christina. "A, T, C, G. Das 'Buch der Natur'." In 10 + 5 = Gott: die Macht der Zeichen; *[Begleitbuch zur Ausstellung '10 + 5 = Gott. Die Macht der Zeichen', Berlin, Jüdisches Museum, 25. Februar bis 27. Juni 2004]*, eds. Daniel Tyradellis and Michal S. Friedlander. 267–268. Köln: DuMont, 2004.

1 Brandt, Christina. *Metapher und Experiment: von der Virusforschung zum genetischen Code.* Wissenschaftsgeschichte, Göttingen: Wallstein, 2004.

Brandt, Christina. "Genetic code, text, and scripture: metaphors and narration in German molecular biology." *Science in Context* 18 (4 2005): 629–648.

Bührig, Claudia. "'Alle Wege führen nach Rom'. Die Einbindung der Dekapolisstädte in das römische Verkehrsnetz." In *Gesichter des Orients: 10000 Jahre Kunst und Kultur aus Jordanien: [Begleitband zur Ausstellung der Kunst- und Ausstellungshalle der Bundesrepublik Deutschland, Bonn, in Kooperation mit dem Vorderasiatischen Museum, Staatliche Museen zu Berlin – Stiftung Preußischer Kulturbesitz]*, eds. Beate Salje, Nadine Riedl, and Günther Schauerte. 183–193. Mainz am Rhein: von Zabern, 2004.

Bührig, Claudia. "Von der befestigten Kuppensiedlung zur repräsentativen Straßensiedlung entlang der Ost-West-Achse. Wachstumsphasen der hellenistisch-

römischen Stadt Gadara." In *Die Stadt als Großbaustelle: von der Antike bis zur Neuzeit; internationaler Kongreß vom 7. bis 11. November 2001 im Auswärtigen Amt, Berlin*, eds. Uta Dirschedl and Deutsches Archäologisches Institut. 56–65. Berlin: Mann [u. a.], 2004.

Bührig, Claudia and Hans-Dieter Bienert. "Archäologie – vom Abenteuer zur Wissenschaft. Spuren deutscher archäologischer Forschung in Jordanien." In *Gesichter des Orients: 10000 Jahre Kunst und Kultur aus Jordanien: [Begleitband zur Ausstellung der Kunst- und Ausstellungshalle der Bundesrepublik Deutschland, Bonn, in Kooperation mit dem Vorderasiatischen Museum, Staatliche Museen zu Berlin–Stiftung Preußischer Kulturbesitz]*, eds. Beate Salje, Nadine Riedl, and Günther Schauerte. 257–267. Mainz am Rhein: von Zabern, 2004.

1 Büscher, Barbara, Hans Christian von Herrmann, and Christoph Hoffmann, eds. *Ästhetik als Programm: Max Bense/Daten und Streuungen*. Kaleidoskopien; 5. Berlin: Vice Versa, 2004.

Büttner, Jochen. "Of dwarves and giants: the transformation of astronomical worldviews." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 84–89. Weinheim: Wiley-VCH, 2005.

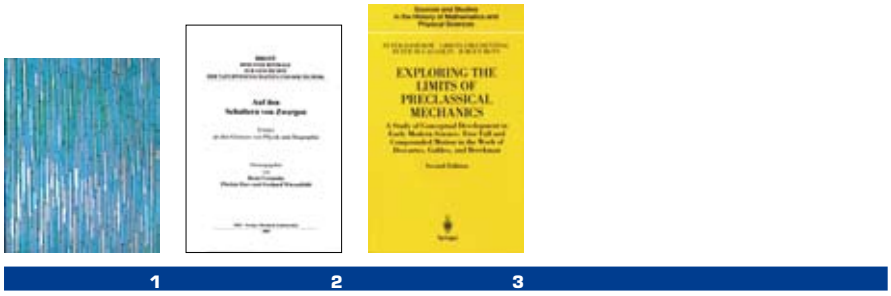
Büttner, Jochen. "Von Zwergen und Riesen: Die Umgestaltung astronomischer Weltbilder." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 84–89. Weinheim: Wiley-VCH, 2005.

Büttner, Jochen, Peter Damerow, and Jürgen Renn. "Galileo's unpublished treatises. A case study on the role of shared knowledge in the emergence and dissemination of an early modern 'new science'." In *The reception of the Galilean science of motion in seventeenth-century Europe*, eds. Carla Rita Palmerino and J. M. M. H. Thijssen. 99–117. Dordrecht: Kluwer, 2004.

Carroy, Jacqueline and Henning Schmidgen. "Reaktionsversuche in Leipzig, Paris und Würzburg: Die deutsch-französische Geschichte eines psychologischen Experiments, 1890–1910." *Medizinhistorisches Journal* 39 (1 2004): 27–55.

2 Ceranski, Beate, Florian Hars, and Gerhard Wiesenfeldt, eds. *Auf den Schultern von Zwergen: Essays an den Grenzen von Physik und Biografie*. Berliner Beiträge zur Geschichte der Naturwissenschaften und der Technik; 31. Berlin [u. a.]: ERS-Verlag, 2005.

Chadarevian, Soraya de. "Mapping the worm's genome: tools, networks, patronage." In *From molecular genetics to genomics: the mapping cultures of twentieth century genetics*, eds. Jean-Paul Gaudillière and Hans-Jörg Rheinberger. 95–110. London [u. a.]: Routledge, 2004.



Crivellari, Fabio, Bernhard Kleeberg, and Walter Tilmann. "Urmensch und Wissenschaftskultur: Einleitung." In *Urmensch und Wissenschaftskultur: eine Bestandsaufnahme*, eds. Bernhard Kleeberg, Walter Tilmann, and Fabio Crivellari. 7–24. Darmstadt: Wissenschaftliche Buchgesellschaft, 2005.

Dacome, Lucia. "Commonplace books and the pursuit of the self in eighteenth-century Britain." *Journal of the History of Ideas* 65 (4 2004 (publ. 2005)): 603–625.

Dacome, Lucia. "'To what purpose does it think?' Dreams, sick bodies and confused minds in the age of reason." *History of Psychiatry* 15 (4 2004): 395–416.

Dahl, Jacob L. "The quest for eternity: studies in neo-sumerian systems of succession." In *Assyria and beyond: studies presented to Mogens Trolle Larsen*, ed. Jan Gerrit Dercksen. 117–136. Leiden: Nederlands Instituut voor het Nabije Oosten, 2004.

Dahl, Jacob L. "Complex graphemes in proto-elamite." *Cuneiform Digital Library Journal* 4 (3 2005): http://cdli.ucla.edu/pubs/cdlj/2005/cdlj2005_003

Damerow, Peter *see also: Büttner, Damerow et al.*

Damerow, Peter *see also: Nissen, Damerow et al.*

Damerow, Peter. "Die Rolle des Werkzeugs bei der Ausbildung der Mechanik als Wissenschaft." In *Hegel und das mechanistische Weltbild: vom Wissenschaftsprinzip Mechanismus zum Organismus als Vernunftbegriff*, ed. Renate Wahsner. 27–42. Frankfurt a. M. [u. a.]: Lang, 2005.

3 Damerow, Peter, Gideon Freudenthal, Peter McLaughlin, and Jürgen Renn. *Exploring the limits of preclassical mechanics: a study of conceptual development in early modern science; free fall and compounded motion in the work of Descartes, Galileo, and Beeckman*. 2. ed., New York [u. a.]: Springer, 2004.

Damerow, Peter and Siegbert Schmidt. "Arithmetik im historischen Prozeß: wie 'natürlich' sind die 'natürlichen Zahlen'?" In *Arithmetik als Prozeß*, eds. Gerhard N. Müller, Heinz Steinbring, and Erich C. Wittmann. 131–182. Seelze: Kallmeyer, 2004.

Daston, Lorraine *see also: Sturm, Carl and Daston.*

Daston, Lorraine. "Attention and the values of nature in the Enlightenment." In *The moral authority of nature*, eds. Lorraine Daston and Fernando Vidal. 100–126. Chicago, Ill. [u. a.]: Univ. of Chicago Press, 2004.

Daston, Lorraine. "The glass flowers." In *Things that talk: object lessons from art and science*, ed. Lorraine Daston. 223–254. New York: Zone Books, 2004.

Daston, Lorraine. "The morality of natural orders: the power of Medea." In *The Tanner lectures on human values, vol. 24*, ed. Grethe B. Peterson. 373–392. Salt Lake City: Univ. of Utah Press, 2004.

Daston, Lorraine. "Nature's customs versus nature's laws." In *The Tanner lectures on human values, vol. 24*, ed. Grethe B. Peterson. 392–411. Salt Lake City: Univ. of Utah Press, 2004.

Daston, Lorraine. "Scientific error and the ethos of belief." In *Research report 2002–2003*, ed. Max-Planck-Institut für Wissenschaftsgeschichte. 51–67. Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, 2004.

Daston, Lorraine. "Speechless." In *Things that talk: object lessons from art and science*, ed. Lorraine Daston. 9–24. New York: Zone Books, 2004.

Daston, Lorraine. "Taking note(s)." *Isis* 95 (3 2004): 443–448.

1 Daston, Lorraine, ed. *Things that talk: object lessons from art and science*. New York: Zone Books, 2004.

Daston, Lorraine. "Type specimens and scientific memory." *Critical Inquiry* 31 (1 2004): 153–182.

Daston, Lorraine. "Whither critical inquiry?" *Critical Inquiry* 30 (2 2004): 361–364.

Daston, Lorraine. "Bilder der Wahrheit, Bilder der Objektivität." In *Einbildungen*, ed. Jörg Huber. 117–153. Zürich: Ed. Voldemeer [u. a.], 2005.

Daston, Lorraine. "Description by omission: nature enlightened and obscured." In *Regimes of description: in the archive of the eighteenth century*, eds. John Bender and Michael Marrinan. 11–24. Stanford, Calif.: Stanford Univ.Press, 2005.

Daston, Lorraine. "Galaxy." In Der Einstein-Komplex: *99 Philosophen, Schriftsteller, Künstler und Wissenschaftler über ein Genie*, eds. Gerd Weiberg and Frank Berberich. 60. Heidelberg: Verlag Das Wunderhorn, 2005.

Daston, Lorraine. "Hard facts." In *Making things public: atmospheres of democracy*, eds. Bruno Latour and Peter Weibel. 680–685. Cambridge, Mass. [u. a.]: MIT Press [u. a.], 2005.

2 Daston, Lorraine. *The history of science as European self-portraiture*. Praemium Erasmianum Essay, Amsterdam: Praemium Erasmianum, 2005.

Daston, Lorraine. "Intelligences: amgelic, animal, human." In *Thinking with animals: new perspectives on anthropomorphism*, eds. Lorraine Daston and Gregg Mitman. 37–58. New York: Columbia Univ. Press, 2005.

Daston, Lorraine. "Scientific error and the ethos of belief." *Social Research* 72 (1 2005): 1–28.

Daston, Lorraine and Gregg Mitman. "Introduction: the how and why of thinking with animals." In *Thinking with animals: new perspectives on anthropomorphism*, eds. Lorraine Daston and Gregg Mitman. 1–14. New York: Columbia Univ. Press, 2005.

3 Daston, Lorraine and Gregg Mitman, eds. *Thinking with animals: new perspectives on anthropomorphism*. New York: Columbia Univ. Press, 2005.

Daston, Lorraine and Joan Richards. "I. Bernard Cohen obituary." *Physics Today* 57 (7 2004): 75.

Daston, Lorraine and Fernando Vidal. "Introduction: doing what comes naturally, I." In *The moral authority of nature*, eds. Lorraine Daston and Fernando Vidal. 1–23. Chicago, Ill. [u. a.]: Univ. of Chicago Press, 2004.

4 Daston, Lorraine and Fernando Vidal, eds. *The moral authority of nature*. Chicago, Ill. [u. a.]: Univ. of Chicago Press, 2004.

Debaise, Didier. "Que signifie 'l'être comme puissance'?" In *Chromatikon I: Annuaire de la philosophie en procès—Yearbook of Philosophy in Process,* ed. Michel Weber. 47–56. Louvain-la-Neuve: Presses universitaires de Louvain, 2005.

5 Denz, Cornelia and Annette Vogt. *Einsteins Kolleginnen – Physikerinnen gestern & heute*. Bielefeld: TeDiC, 2005.

Dierig, Sven. *see also: Schmidgen, Geimer and Dierig*

Dierig, Sven. "Die Kunst des Versuchens. Emil du Bois-Reymonds 'Untersuchungen über thierische Elektricität'." In *Kultur im Experiment*, eds. Henning Schmidgen, Peter Geimer, and Sven Dierig. 123–146. Berlin: Kulturverlag Kadmos, 2004.

Dierig, Sven. "[Entry] 'Ludwig'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 437–438. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

1 Dierig, Sven and Thomas Schnalke, eds. *Apoll im Labor: Bildung, Experiment, mechanische Schönheit; eine Ausstellung des Berliner Medizinhistorischen Museums der Charité in Zusammenarbeit mit dem Max-Planck-Institut für Wissenschaftsgeschichte, 13. Mai bis 2. Oktober 2005; Begleitbuch*. Berlin: Berliner Medizinhistorisches Museum, 2005.

Doel, Ronald E., Dieter Hoffmann, and Nikolai Krementsov. "National states and international science: a comparative history of international science congresses in Hitler's Germany, Stalin's Russia, and Cold War United States." *Osiris* 20 (2005): 49–76.

Dörries, Matthias. "[Entry] 'Johann von Lamont'." In *Oxford dictionary of national biography,* eds. Brian Harrison and Henry C. G. Matthew. Oxford: Oxford Univ. Press, 2004.

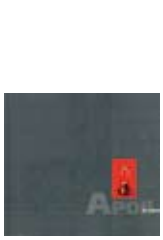
Dongen, Jeroen van. "Einstein's methodology, semivectors and the unification of electrons and protons." *Archive for History of Exact Sciences* 58 (3 2004): 219–254.

Dongen, Jeroen van and Sebastian de Haro. "On black hole complementarity." *Studies in History and Philosophy of Modern Physics* 35 (3 2004): 509–525.

Dupouy, Stéphanie. "Künstliche Gesichter: Rodolphe Töpffer und Duchenne de Boulogne." In *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 24–60. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Eddy, Matthew D. "Scottish chemistry, classification and the late mineralogical career of the 'ingenious' Professor John Walker (1779–1803)." *The British Journal for the History of Science* 37 (4 2004): 373–399.

2 Endres, Johannes, Barbara Wittmann, and Gerhard Wolf, eds. *Ikonologie des Zwischenraums: der Schleier als Medium und Metapher.* Bild und Text. München: Fink, 2005.



1 2 3

3 Fan, Fa-ti. *British naturalists in Qing China: science, empire, and cultural encounter*. Cambridge, Mass. [u. a.]: Harvard Univ. Press, 2004.

Fan, Fa-ti. "[Entry] 'John Reeves'." In *Oxford dictionary of national biography*, eds. Brian Harrison and Henry C. G. Matthew. Oxford: Oxford Univ. Press, 2004.

Fazekas, Péter and Gábor A. Zemplén. "Molyneux kérdései – a reprezentáció filozófiai problémájától az intermodális transzferig." *Magyar Pszichológiai Szemle* 60 (4 2005): 527–552.

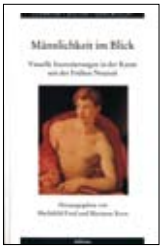
Feest, Uljana. "Giving up instincts in psychology—or not?" In *Recent contributions to the history of the human sciences: Proceedings of the 21st Annual conference of the European Society for the History of the Human Sciences Barcelona 2002*, eds. Annette Mülberger and Beni Gómez-Zuniga. 245–259. München: Profil-Verlag, 2005.

Feest, Uljana. "Operationism in psychology: What the debate is about, what the debate should be about." *Journal of the History of the Behavioral Sciences* 41 (2 2005): 131–149.

Feest, Uljana and Stephanie Koerner. "Historizing instincts: a cross-disciplinary panel." In *Recent contributions to the history of the human sciences: Proceedings of the 21st Annual conference of the European Society for the History of the Human Sciences Barcelona 2002*, eds. Annette Mülberger and Beni Gómez-Zuniga. 177–192. München: Profil-Verlag, 2005.

Felsch, Philipp. "Die Stadt, der Lärm und der Ruß: mechanische Spuren der Psyche, 1875–1985." In *Psychographien*, eds. Cornelius Borck and Armin Schäfer. 17–42. Zürich [u. a.]: Diaphanes, 2005.

Felsch, Philipp. "Ganzheit und ihre Apparaturen: konstitutionelle Medizin um 1900." In *Maß und Eigensinn: Studien im Anschluß an Georges Canguilhem*, eds. Cornelius Borck, Volker Hess, and Henning Schmidgen. 135–156. München: Fink, 2005.



1

Fend, Mechthild. "Jungfräuliche Knaben: Androgynie und männliche Adoleszenz in der Bildkultur um 1800." In *Männlichkeit im Blick: visuelle Inszenierungen in der Kunst seit der Frühen Neuzeit*, eds. Mechthild Fend and Marianne Koos. 181–198. Köln [u. a.]: Böhlau, 2004.

Fend, Mechthild. "Medium Haut. Oberflächen und Körpergrenzen in Malerei und Medizin des 19. Jahrhunderts." In *Medien der Kunst: Geschlecht, Metapher, Code; Beiträge der 7. Kunsthistorikerinnen-Tagung in Berlin 2002*, eds. Susanne von Falkenhausen, Silke Förschler, Ingeborg Reichle, and Bettina Uppenkamp. 242–256. Marburg: Jonas, 2004.

Fend, Mechthild. "Bodily and pictorial surfaces: skin in French art and medicine, 1790–1860." *Art History* 28 (3 2005): 311-339.

Fend, Mechthild. "Körpersehen: über das Haptische bei Alois Riegl." In *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 166–202. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Fend, Mechthild and Marianne Koos. "Einleitung." In *Männlichkeit im Blick: visuelle Inszenierungen in der Kunst seit der Frühen Neuzeit*, eds. Mechthild Fend and Marianne Koos. 1–13. Köln [u. a.]: Böhlau, 2004.

1 Fend, Mechthild and Marianne Koos, eds. *Männlichkeit im Blick: visuelle Inszenierungen in der Kunst seit der Frühen Neuzeit*. Literatur, Kultur, Geschlecht; 30. Köln [u. a.]: Böhlau, 2004.

Fiorentini, Erna. "Subjective objective. The Camera Lucida and protomodern observers." In *Instrumente des Sehens*, eds. Horst Bredekamp and Gabriele Werner. 58–66. Berlin: Akademie-Verlag, 2004.

Fiorentini, Erna. "Nuovi punti di vista. Giacinto Gigante e la camera lucida a Napoli." In *Pittura italiana nell'Ottocento*, eds. Martina Hansmann and Max Seidel. 535–557. Venezia: Marsilio, 2005.

Fiorentini, Erna. "Observing nature— representing experience: practices and concepts 1800–1850." *AHF-Information* 14 (2005): 1–5.

Fiorentini, Erna. "Schatten an der Wand. Zu Gregg M. Horowitz' 'Alte Medien'." In *Zwischen Ding und Zeichen: zur ästhetischen Erfahrung in der Kunst*, eds. Gertrud Koch and Christiane Voss. 80–85. München [u. a.]: Fink, 2005.

Francoeur, Eric and Jérôme Ségal. "From model kits to interactive computer graphics." In *Models: the third dimension of scienc*e, eds. Soraya de Chadarevian and Nick Hopwood. 402–429. Stanford, Calif.: Stanford Univ. Press, 2004.

Frank, Tibor. "Supranational English, American values, and East-Central Europe." *Publications of the Modern Language Association of America: PMLA* 119 (1 2004): 80–91.

Franke-Heubach, Elke see: *Schneider and Franke-Heubach*

Freudenthal, Gideon *see: Damerow, Freudenthal et al.*

Fuchs, Eckhardt. "The 'International Catalogue of Scientific Literature' as a mode of intellectual transfer: promise and pitfalls of international scientific co-operation before 1914." In *Transnational intellectual networks: forms of academic knowledge and the search for cultural identities*, eds. Christoph Charle, Jürgen Schriewer, and Peter Wagner. 165–193. Frankfurt a. M. [u. a.]: Campus-Verlag, 2004.

Fuchs, Eckhardt. "Nature and Bildung: pedagogical naturalism in nineteenth-century Germany." In *The moral authority of natur*e, eds. Lorraine Daston and Fernando Vidal. 155–181. Chicago, Ill. [u. a.]: Univ. of Chicago Press, 2004.

Fuchs, Eckhardt and Dieter Hoffmann. "Philanthropy and science in Wilhelmine Germany." In *Philanthropy, patronage, and civil society: experiences from Germany, Great Britain, and North America*, ed. Thomas Adam. 103–119. Bloomington: Indiana Univ. Press, 2004.

Gantet, Claire. "Die französische Geschichtsschreibung der Gegenwart: ein Essay." *Zeitenblicke* 3 (1 2004): http://zeitenblicke.historicum.net/2004/01/gantet/index.html

Gantet, Claire. "La construction d'un espace étatique: perceptions et représentations des frontières extérieures du Saint-Empire au XVIIe siècle." In *L'espace du Saint-Empire du Moyen âge à l'époque moderne*, ed. Christine Lebeau. 33–49. Strasbourg: Presses Univ. de Strasbourg, 2004.

Gantet, Claire. "Les représentations politiques de l'espace du Saint-Empire dans les 'rêves' et les 'visions' fictifs, de la guerre de Trente Ans à la fin du XVIIe siècle." *Histoire, Économie et Société* 23 (1 2004): 25–37.

1

Gantet, Claire. "Peace ceremonies and respect for authority: The 'Res Publica', 1648–1660." *French History* 18 (13 2004): 275–290.

Gantet, Claire and Fernando Vidal. "Âme." *Bulletin de la Societé Française pour l'Histoire des Sciences de l'Homme* 28 (Automne/Hiver 2005): 50–60.

Gaudillière, Jean-Paul *see also: Rheinberger and Gaudillière*

Gaudillière, Jean-Paul. "Mapping as technology: genes, mutant mice, and biomedical research (1910–65)." In *Classical genetic research and its legacy: the mapping cultures of twentieth-century genetics*, eds. Hans-Jörg Rheinberger and Jean-Paul Gaudillière. 173–203. London: Routledge, 2004.

Gaudillière, Jean-Paul. "Mobiliser les sciences pour vaincre le cancer: fondation, État et industrie aux États-Unis." In *Les sciences pour la guerre, 1940–1960*, eds. Amy Dahan and Dominique Pestre. 343–368. Paris: Ed. de l'EHESS, 2004.

Gaudillière, Jean-Paul and Bernd Gausemeier. "Molding national research sytems: the introduction of penicillin to Germany and France." *Osiris* 20 (2005): 180–202.

1 Gaudillière, Jean-Paul and Hans-Jörg Rheinberger, eds. *From molecular genetics to genomics: the mapping cultures of twentieth century genetics*. Routledge studies in the history of science, technology and medicine; 20. London [u. a.]: Routledge, 2004.

Gaudillière, Jean-Paul and Hans-Jörg Rheinberger. "Introduction." In *From molecular genetics to genomics: the mapping cultures of twentieth century genetics*, eds. Jean-Paul Gaudillière and Hans-Jörg Rheinberger. 1–6. London [u. a.]: Routledge, 2004.

Gaudillière, Jean-Paul and Hans-Jörg Rheinberger. "'Life stories'. Essay review of Chadarevian, Soraya de: Designs for life. Cambridge: Cambridge Univ. Press 2002, and Creager, Angela: The life of a virus. Chicago: Univ. of Chicago Press 2002." *Studies in History and Philosophy of Biological and Biomedical Sciences* 35C (4 2004): 753–764.

Gausemeier, Bernd *see: Gaudillière and Gausemeier*

Geimer, Peter *see also: Schmidgen, Geimer and Dierig*

Geimer, Peter. "Bild und Maß. Zur Typologie fotografischer Bilder." In E*inführung in die Kunstwissenschaft,* eds. Thomas Hensel and Andreas Koestler. 157–177. Berlin: Reimer, 2004.

Geimer, Peter. "Das Gewicht der Engel. Eine Physiologie des Unmöglichen." In *Kultur im Experiment*, eds. Henning Schmidgen, Peter Geimer, and Sven Dierig. 170–190. Berlin: Kulturverlag Kadmos, 2004.

Geimer, Peter. "Picturing the black box: On blanks in nineteenth century paintings and photographs." *Science in Context* 17 (4 2004): 467–501.

Geimer, Peter. "Telepathie." In *Science & Fiction. Über Gedankenexperimente in Wissenschaft, Philosophie und Literatur*, eds. Thomas Macho and Annette Wunschel. 287–309. Frankfurt am Main: Fischer Taschenbuch Verlag, 2004.

Geimer, Peter. "Fotografie als Wissenschaft." *Berichte zur Wissenschaftsgeschichte* 28 (2 2005): 114–122.

Geimer, Peter. "Getrübte Blicke: William Turner in augenärztlicher Betrachtung." *In Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 139–165. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Geimer, Peter. "Über Reste." In *Dingwelten: das Museum als Erkenntnisort*, eds. Anke te Heesen and Petra Lutz. 109–118. Köln [u. a.]: Böhlau, 2005.

Gervain, Judit and Gábor A. Zemplén. "Focus raising: a paradigmatic example of the treatment of syntactic variation." In *Syntax and variation: reconciling the biological and the social*, eds. Leonie Cornips and Karen P. Corrigan. 123–145. Amsterdam [u. a.]: Benjamins, 2005.

Ginsborg, Hannah. "Two kinds of mechanical inexplicability in Kant and Aristotle." *Journal of the History of Philosophy* 42 (1 2004): 33–65.

Ginsborg, Hannah. "Kant's aesthetics and teleology." In *The Stanford Encyclopedia of Philosophy*, ed. Edward N. Zalta. Stanford, Calif.: Stanford Univ., 2005.

Griesecke, Birgit. "Am Beispiel 'Versuch'. Warum Wittgensteins Philosophie die Kulturgeschichte der Wissenschaften herausfordern kann." In *'fülle der combination': Literaturforschung und Wissenschaftsgeschichte*, eds. Bernhard J. Dotzler and Sigrid Weigel. 267–291. München: Fink, 2005.

Griesecke, Birgit. "Intime Experimente: unterwegs in japanischen Schlaflaboren mit Ariyoshi, Tanizaki und Kawabata." *Nachrichten der Gesellschaft für Natur- und Völkerkunde Ostasiens: Zeitschrift für Kultur und Geschichte Ost- und Südostasiens* 177–178 (2005): 7–36.

Griesecke, Birgit. "Pathologische Sprachspiele?: zur Normalisierung von Rausch und Schmerz." In *Maß und Eigensinn: Studien im Anschluß an Georges Canguilhem*, eds. Cornelius Borck, Volker Hess, and Henning Schmidgen. 91–107. München: Fink, 2005.

Griesecke, Birgit. "Was machen normale Menschen, wenn sie nicht schlafen? Ludwik Fleck, Izydora Dambska und die ethnografische Herausforderung der frühen Wissenschaftssoziologie." In *Tatsache – Denkstil – Kontroverse: Auseinandersetzungen mit Ludwik Fleck*, ed. Rainer Egloff. 21–27. Zürich: Collegium Helveticum, 2005.

Griesecke, Birgit and Werner Kogge. "Forcierte Schließungen. Wittgenstein und der Weg vom mathematischen Formalismus in die moderne Genetik." In *Wahn – Wissen – Institution: undisziplinierbare Näherungen*, eds. Karl-Josef Pazzini, Marianne Schuller, and Michael Wimmer. 27–55. Bielefeld: Transcript-Verlag, 2005.

Griesecke, Birgit and Werner Kogge. "Was ist eigentlich ein Gedankenexperiment?: Mach, Wittgenstein und der neue Experimentalismus." In *Literarische Experimentalkulturen: Poetologien des Experiments im 19. Jahrhundert*, eds. Marcus Krause and Nicolas Pethes. 41–72. Würzburg: Königshausen & Neumann, 2005.

1 Gruber, Howard and Katja Bödeker, eds. *Creativity, psychology and the history of science*. Boston studies in the philosophy of science; 245. Dordrecht: Springer, 2005.

Hagner, Michael *see also: Vöhringer and Hagner*

2 Hagner, Michael. *Geniale Gehirne: zur Geschichte der Elitegehirnforschung*. Wissenschaftsgeschichte, Göttingen: Wallstein, 2004.

Handelman, Don. "Epilogue: dark soundings—towards a phenomenology of night." *Paideuma* 51 (2005): 247–261.

Handelman, Don. "Introduction: Why ritual in its own right? How so?" In *Ritual in its own right: exploring the dynamics of transformation*, eds. Don Handelman and Galina Lindquist. 1–32. New York [u. a.]: Berghahn Books, 2005.

Handelman, Don. "Microhistorical anthropology: toward a prospective perspective." In *Critical junctions: anthropology and history beyond the cultural turn*, eds. Don Kalb and Herman Tak. 29–52. New York [u. a.]: Berghahn Books, 2005.

1 2 3

Harwood, Jonathan. "Comments on Andrew Pickering's paper." *Perspectives on Science* 13 (3 2005): 411–415.

Harwood, Jonathan. "On the genesis of technoscience: a case study of German agricultural education." *Perspectives on Science* 13 (3 2005): 329–351.

3 Harwood, Jonathan. *Technology's dilemma: agricultural colleges between science and practice in Germany, 1860–1934*. Oxford [u. a.]: Lang, 2005.

Hau, Michael. "The humane expert: physicians, empathy and the crisis of modern medicine during the Weimar Republic." In *Experts in science and society*, eds. Elke Kurz-Milcke and Gerd Gigerenzer. 105–122. New York [u. a.]: Kluwer, 2004.

Heesen, Anke te *see also: Joly, te Heesen et al.*

Heesen, Anke te. "[Entry] 'Messerschmidt'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 12. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Heesen, Anke te. "Faktenmontagen." In *'Quelle': zwischen Ursprung und Konstrukt; ein Leitbegriff in der Diskussion*, eds. Thomas Rathmann and Nikolaus Wegmann. 66–88. Berlin: Schmidt, 2004.

Heesen, Anke te. "From natural history investment to state service: collectors and collections of the Berlin Society of Friends of Nature Research, c. 1800." *History of Science* 42 (135,1 2004): 113–131.

Heesen, Anke te. "News, paper, scissors: Clippings in the sciences and arts around 1920." In *Things that talk: object lessons from art and science*, ed. Lorraine Daston. 297–327. New York: Zone Books, 2004.

Heesen, Anke te. "Nichts ist so aktuell wie die Zeitung von gestern. Von der kriminalistischen Nobilitierung des Zeitungsausschnitts und seinem Einzug in die Kunst und Alltagskultur." *Freitag*, 9. 4. 2004, 18.

1 2

Heesen, Anke te. "Accounting for the natural world: double-entry bookkeeping in the field." In *Colonial botany: science, commerce, and politics in the early modern world*, eds. Londa Schiebinger and Claudia Swan. 237–251. Philadelphia: Univ. of Pennsylvania Press, 2005.

Heesen, Anke te. "DADA/EINSTEIN: ein Physiker in Papier." In *Einstein on the beach: der Physiker als Phänomen*, ed. Michael Hagner. 40–56. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Heesen, Anke te. "Das Muster als materialer Rhythmus." In *Rhythmus: Spuren eines Wechselspiels in Künsten und Wissenschaften*, ed. Barbara Naumann. 261–277. Würzburg: Königshausen & Neumann, 2005.

Heesen, Anke te. "Pflanzen in Kästen. Zur Geschichte eines ordnenden Gevierts." In *Park: Zucht und Wildwuchs in der Kunst*, eds. Johannes Bilstein and Matthias Winzen. 142–149. Nürnberg: Verlag für moderne Kunst, 2005.

Heesen, Anke te. "The notebook: a paper-technology." In *Making things public: atmospheres of democracy*, eds. Bruno Latour and Peter Weibel. 582–589. Cambridge, Mass. [u. a.]: MIT Press [u. a.], 2005.

1 Heesen, Anke te. "Verkehrsformen der Objekte." In *Dingwelten: das Museum als Erkenntnisort*, eds. Anke te Heesen and Petra Lutz. 53–64. Köln [u. a.]: Böhlau, 2005.

Heesen, Anke te and Petra Lutz, eds. *Dingwelten: das Museum als Erkenntnisort*. Köln [u. a.]: Böhlau, 2005.

Heesen, Anke te and Petra Lutz. "Einleitung." In *Dingwelten: das Museum als Erkenntnisort*, eds. Anke te Heesen and Petra Lutz. 11–23. Köln [u. a.]: Böhlau, 2005.

Heesen, Anke te and Juliane Vogel. "Herren mit Schere: Ernst Gehrcke und Karl Kraus." In *Papieroperationen: der Schnitt in die Zeitung*, eds. Jean-Baptiste Joly, Anke te Heesen, and Juliane Vogel. 30–49. Stuttgart: Akademie Schloss Solitude, 2004.

Heintz, Christophe. "Introduction: Why There Should Be a Cognitive Anthroplogy of Science." *Journal of Cognition and Culture* 4 (3–4 2004): 391–408.

Henning, Eckart, Horst Kant, and Annette Vogt. "Hubert Laitko zum 70. Geburtstag." NTM N.S. 13 (1 2005): 46–47.

Herrmann, Hans-Christian von and Christoph Hoffmann. "'Der geistige Mensch und die Technik'. Max Bense im Labor für Hochfrequenzphysik und Elektromedizin (1941–1945)." In *Ästhetik als Programm: Max Bense/Daten und Streuungen*, eds. Barbara Büscher, Hans-Christian von Herrmann, and Christoph Hoffmann. 18–31. Berlin: Kaleidoskopien, 2004.

Herrmann, Hans-Christian von and Christoph Hoffmann. "Die Technik geistig in der Hand halten. Der Roman eines Labors: Max Bense entwickelte aus seinen praktischen Erfahrungen als Physiker im Zweiten Weltkrieg die Basis für die von ihm angestrebte höhere Art der Aufklärung." *Frankfurter Allgemeine Zeitung*, 28. 08. 2004, 39.

Höhler, Sabine *see also: Schröder and Höhler*

Höhler, Sabine. "'Raumschiff Erde': Lebensraumphantasien im Umweltzeitalter." In *Welt-Räume: Geschichte, Geographie und Globalisierung seit 1900*, eds. Iris Schröder and Sabine Höhler. 258–281. Frankfurt a. M. [u. a.]: Campus-Verl., 2005.

2 Hörisch, Jochen, Jan Phillip Reemtsma, Jürgen Lüthje, Walter C. Zimmerli, and Hans-Jörg Rheinberger, eds. *Geisteswissenschaften – wozu?: eine Reihe mit Vorträgen*. Schriften der Freien Akademie der Künste in Hamburg; 32. Hamburg: Freie Akademie der Künste, 2005.

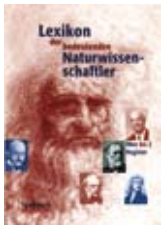
Hoffmann, Christoph *see also: Berz and Hoffmann*

Hoffmann, Christoph *see also: Büscher, Herrmann and Hoffmann*

Hoffmann, Christoph *see also: Herrmann and Hoffmann*

Hoffmann, Christoph. "Eine Maschine und ihr Betrieb. Zur Gründung des Recheninstituts der Technischen Hochschule Stuttgart (1956–1964)." In *Ästhetik als Programm: Max Bense / Daten und Streuungen*, eds. Barbara Büscher, Hans-Christian von Herrmann, and Christoph Hoffmann. 118–129. Berlin: Kaleidoskopien, 2004.

Hoffmann, Christoph. "Vor dem Apparat. Das Wiener Phonogramm-Archiv." In *Bürokratische Leidenschaften: Kultur- und Mediengeschichte im Archiv*, ed. Sven Spieker. 281–294. Berlin: Kulturverlag Kadmos, 2004.



1 2

Hoffmann, Christoph. "Literaturforschung. Über medizinische Schriften Gottfried Benns." In *'fülle der combination': Literaturforschung und Wissenschaftsgeschichte*, eds. Bernhard J. Dotzler and Sigrid Weigel. 319–341. München: Fink, 2005.

Hoffmann, Christoph. "Schreibmaschinenhände. Über 'typographologische' Komplikationen." In *"Schreibkugel ist ein Ding gleich mir: Von Eisen": Schreibszenen im Zeitalter der Typoskripte*, eds. Davide Giuriato, Martin Stingelin, and Sandro Zanetti. 153–167. München: Fink, 2005.

Hoffmann, Dieter *see also: Doel, Hoffmann et al.*

Hoffmann, Dieter *see also: Fuchs and Hoffmann*

Hoffmann, Dieter *see also: Renn and Hoffmann*

Hoffmann, Dieter. "Albert Einstein und die Berliner Friedrich-Wilhelms-Universität." *Impulse der Physik: Zeitschrift der Vereinigung der Freunde und Förderer der Physik der Humboldt-Universität zu Berlin e.V.* (2004): 17–23.

Hoffmann, Dieter. "Einsteins politische Akte." *Physik in unserer Zeit* 35 (2 2004): 64–69.

1 Hoffmann, Dieter. "[Entries] 'Finlay-Freundlich', 'Friedmann', 'Friedrich', 'Fuchs, K.', 'Gaede', 'Geiger', 'Gibbs', 'Goldstein', 'Grotrian', 'Hertz', 'Jordan', 'Kapitza', 'Laue', 'Lomonossow', 'Lorentz', 'Lummer', 'Mach', 'Maxwell', 'Meißner, W.'" In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

2 Hoffmann, Dieter. "[Entries] 'Meyer, S.', 'Millikan', 'Planck', 'Ruska, E.', 'Ruska, H.', 'Seeliger, R.', 'Solvay', 'Stark', 'Steenbeck', 'Volmer', 'Wien, W.', 'Wilcke'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Hoffmann, Dieter. "[Entry] 'Hans Geiger'." In *Oxford dictionary of national biography*, eds. Brian Harrison and Henry C. G. Matthew. 231–233. Oxford: Oxford Univ. Press, 2004.

Hoffmann, Dieter. "Erwin Finlay-Freundlich (1885–1964) und seine Bemühungen um die Institutionalisierung der Astrophysik." In *Wege der Erkenntnis: Festschrift für Dieter B. Herrmann zum 65. Geburtstag*, eds. Dietmar Fürst and Eckehard Rothenberg. 98–105. Frankfurt am Main: Deutsch, 2004.

Hoffmann, Dieter. "Friedrich Möglich (im Forschungszentrum von 1945 bis 1957)." In *Wissenschaftler im biomedizinischen Forschungszentrum: Berlin-Buch 1930–2004; Wissenschaftler-Biographien*, ed. Luise Pasternak. 46–51. Frankfurt am Main [u. a.]: Lang, 2004.

Hoffmann, Dieter. "Fritz Lange (im Forschungszentrum von 1959–1965)." In *Wissenschaftler im biomedizinischen Forschungszentrum: Berlin-Buch 1930–2004; Wissenschaftler-Biographien*, ed. Luise Pasternak. 180-184. Frankfurt am Main [u. a.]: Lang, 2004.

Hoffmann, Dieter. "Geschichte der Physik." In *Faszination Physik*, ed. Katja Bammel. XV–-XXXVI. Heidelberg: Elsevier [u. a.], 2004.

Hoffmann, Dieter. "L'engagement politique d'Einstein." *Pour la Science* (326 2004): 34–38.

Hoffmann, Dieter. "'1905 war sein großes Jahr': Interview mit Hans Bethe." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 422–425. Weinheim: Wiley-VCH, 2005.

Hoffmann, Dieter. "'1905 war sein großes Jahr': Interview mit Hans Bethe." *Physik-Journal* 4 (3 2005): 7–8.

Hoffmann, Dieter. "'1905 was his great year' – Interview with Hans Bethe." In *Einstein—peace now!*, eds. Reiner Braun and David Krieger. 35–41. Weinheim: Wiley-VCH, 2005.

Hoffmann, Dieter. "'1905 was his great year': interview with Hans Bethe." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 422–425. Weinheim: Wiley-VCH, 2005.

Hoffmann, Dieter. "'Anders ist es mit den paar Einzelnen ...': Albert Einsteins Verhältnis zur Deutschen Physikalischen Gesellschaft." *Physik-Journal* 4 (3 2005): 85–90.

Hoffmann, Dieter. "Between autonomy and accommodation: the German Physical Society during the Third Reich." *Physics in Perspective* 7 (3 2005): 293–329.

Hoffmann, Dieter. "Copenhagen was not an isolated case." In *Michael Frayn's Copenhagen in debate: historical essays and documents on the 1941 meeting between Niels Bohr and Werner Heisenberg*, ed. Matthias Dörries. 39–47. Göttingen: Wallstein, 2005.

Hoffmann, Dieter. "Das erste große Team." *DUZ – Magazin* 61 (12 2005): 14–16.

Hoffmann, Dieter. "Das Leben danach: Klaus Fuchs in der DDR." In *Aus Wissenschaftsgeschichte und -theorie. Hubert Laitko zum 70. Geburtstag überreicht von Freunden, Kollegen und Schülern*, eds. Horst Kant and Annette Vogt. 451–463. Berlin: Verlag für Wissenschafts- und Regionalgeschichte Engel, 2005.

Hoffmann, Dieter. "Die Graue Eminenz der DDR-Physik: zum 100. Geburtstag von Robert Rompe." *Physik-Journal* 4 (10 2005): 56–58.

Hoffmann, Dieter. "Einstein in Berlin." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 260–265. Weinheim: Wiley-VCH, 2005.

Hoffmann, Dieter. "Einstein's Berlin." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 260–265. Weinheim: Wiley-VCH, 2005.

Hoffmann, Dieter. "Einstein's political file." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 434–439. Weinheim: Wiley-VCH, 2005.

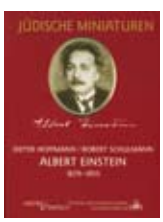
Hoffmann, Dieter. "Einsteins politische Akte." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 434–439. Weinheim: Wiley-VCH, 2005.

Hoffmann, Dieter. "Genie im Hauptberuf." *Der Tagesspiegel*, 18. 04. 2005, 25.

Hoffmann, Dieter. "Lénárd Fülöp – Philipp Lenard: Von Preßburg nach Heidelberg." In *' ... immer im Forschen bleiben': Rüdiger vom Bruch zum 60. Geburtstag*, eds. Marc Schalenberg and Peter T. Walther. 337–350. Stuttgart: Steiner, 2005.

Hoffmann, Dieter. "'Lieber Herr X.'" *Physik-Journal* 4 (3 2005): 27.

Hoffmann, Dieter. "Max-Planck-Denkmal 1948–49." In *Bernhard Heiliger 1915–1995: Monographie und Werkverzeichnis [Ausstellung Bernhard Heiliger 1915–1995: Kosmos eines Bildhauers, Martin-Gropius-Bau, Berlin 5. Nov. 2005 bis 15. Jan. 2006]*, ed. Marc Wellmann. 116–119. Köln: Wienand, 2005.



1 2

Hoffmann, Dieter. "Vom Luxus des Gewissens – Max Born und Albert Einstein im Spiegel ihres Briefwechsels." In *Max Born und Albert Einstein im Dialog: Festschrift zum Forum 2005*, ed. Förderverein des Max-Born-Berufskollegs Kemnastraße. 76–98. Recklinghausen: Förderverein des Max-Born-Berufskollegs Kemnastraße, 2005.

Hoffmann, Dieter, Hubert Laitko, and Staffan Müller-Wille, eds. *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Hoffmann, Dieter, Hubert Laitko, and Staffan Müller-Wille, eds. *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Hoffmann, Dieter and Jürgen Renn. "Albert Einstein." In *(In Japanese) Einstein in Japan: a travelogue [Exhibition, Mitsuo Aida Museum Tokyo, 20.12. 2005 – 26. 2. 2006]*, 16–25. Tokio: Mitsuo Aida Museum, 2005.

Hoffmann, Dieter and Hermann Roloff. *Kunstwerke bei DESY in Zeuthen: zur Geschichte der beiden Großplastiken*. Interner Bericht DESY Zeuthen; 05–01, 2005.

1 Hoffmann, Dieter and Robert Schulmann, eds. *Albert Einstein: (1879–1955)*. Jüdische Miniaturen; 25. Teetz: Hentrich & Hentrich, 2005.

Hoffmann, Dieter and Mark Walker. "The German Physical Society under national socialism." *Physics Today* 57 (12 2004): 52-58.

Hon, Giora and Bernard R. Goldstein. "Symmetry in Copernicus and Galileo." *Journal for the History of Astronomy* 35 (3 2004): 273–292.

2 Hucho, Ferdinand, Klaus Brockhoff, Wolfgang van den Daele, Kristian Köchy, Jens Reich, Hans-Jörg Rheinberger, Bernd Müller-Röber, Karl Sperling, Anna M. Wobus, Mathias Boysen, and Meike Kölsch, eds. *Gentechnologiebericht: Analyse einer Hochtechnologie in Deutschland.* Forschungsberichte der interdisziplinären Arbeitsgruppen der Berlin-Brandenburgischen Akademie der Wissenschaften; 14. München: Elsevier Spektrum, 2005.

1 2 3

Hyman, Malcolm. "Terms for 'Word' in Roman grammar." In *Antike Fachtexte*, ed. Thorsten Fögen. 155–170. Berlin [u. a.]: de Gruyter, 2005.

Iglhaut, Stefan and Jürgen Renn. "Wider den akademischen Dünkel: zwei Ausstellungsmacher sprechen über die Schwierigkeit, ein Genie zu inszenieren." In *Meister Einstein: was Mensch und Wissenschaft von ihm lernen können*. 76–79. Hamburg: Zeitverlag, 2005.

Jackson, Myles W. "Machines and musical pedagogy in Germany." *History of Science* 42 (138,4 2004): 371–418.

1 Jacob, Margaret C. and Larry Stewart. *Practical matter: Newton's science in the service of industry and empire, 1687–1851*. Cambridge: Harvard Univ. Press, 2004.

2 Joly, Jean-Baptiste, Anke te Heesen, and Juliane Vogel, eds. *Papieroperationen: der Schnitt in die Zeitung*. Neue Freunde: zum aktuellen Stand von art, science & business; 2. Stuttgart: Akademie Schloss Solitude, 2004.

Jones, Caroline A. "Talking pictures: Clement Greenberg's Pollock." In *Things that talk: object lessons from art and science*, ed. Lorraine Daston. 329–373. New York: Zone Books, 2004.

Kant, Horst see also: Henning, Kant and Vogt

Kant, Horst. "[Entries] 'Fajans', 'Fermi', 'Fljorow', 'Fock', 'Franck', 'Frisch', 'Hahn', 'Hevesy', 'Ioffe', 'Joliot-Curie, I.', 'Joliot-Curie, J. F.', 'Kamerlingh Onnes', 'Kurtschatow', 'Lambert', 'Lawrence', 'Mandelstam', 'Meitner'." In *Lexikon der bedeutenden Natur-wissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Kant, Horst. "[Entries] 'Moseley', 'Nobel', 'Noddack, I. E.', 'Noddack, W.', 'Paschen', 'Peierls', 'Poggendorf', 'Powell', 'Prochorow', 'Rajewski' 'Rayleigh', 'Richardson', 'Röntgen' 'Siegbahn', 'Soddy' 'Stoletov', 'Tamm', 'Thomson, G. P., 'Thomson, J. J.', 'van der Waals', 'Wiedemann, G. H.', 'Wróblewski', 'Yukawa'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann,

Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Kant, Horst. "Albert Einstein and the Kaiser Wilhelm Institute for Physics in Berlin." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 166–169. Weinheim: Wiley-VCH, 2005.

Kant, Horst. "Albert Einstein und das Kaiser-Wilhelm-Institut für Physik in Berlin." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 166–169. Weinheim: Wiley-VCH, 2005.

Kant, Horst. "Betrachtungen zur Physik an der Reichsuniversität Straßburg 1942–1944." In *Les Reichsuniversitäten de Strasbourg et de Poznan et les résistances universitaires 1941–1944*, eds. Christian Baechler, François Igersheim, and Pierre Racine. 185–203. Strasbourg: Presses Universitaires de Strasbourg, 2005.

Kant, Horst. "Contribution à l'histoire de la physique à Strasbourg 1941–1944." In *La science sous influence: l'université de Strasbourg enjeu des conflits franco-allemands 1872–1945*, eds. Elisabeth Crawford and Josiane Olff-Nathan. 257–267. Strasbourg: La Nuée Bleue, 2005.

Kant, Horst. "Deutsche Naturwissenschaftler und die Wirkungen des Russell-Einstein-Manifestes." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 430–433. Weinheim: Wiley-VCH, 2005.

Kant, Horst. "[Entries] 'Rubens', 'Rüchardt', 'Scheibe', 'Scherrer'." In *Neue Deutsche Biographie. Bd. 22*, ed. Historische Kommission der Bayerischen Akademie der Wissenschaften. Berlin: Duncker & Humblot, 2005.

Kant, Horst. "Forschungen über Radioaktivität am Kaiser-Wilhelm-Institut für Chemie: die Abteilung(en) Hahn/Meitner und ihre internationalen Kontakte." In *Aus Wissenschaftsgeschichte und -theorie. Hubert Laitko zum 70. Geburtstag überreicht von Freunden, Kollegen und Schülern*, eds. Horst Kant and Annette Vogt. 289–320. Berlin: Verlag für Wissenschafts- und Regionalgeschichte Engel, 2005.

Kant, Horst. "German scientists and the effects of the Russell-Einstein manifesto." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 430–433. Weinheim: Wiley-VCH, 2005.

Kant, Horst. "Wissenschaft in Berlin: Geschichte – Gegenwart – Zukunft. Kolloquium anlässlich des 70. Geburtstages von Hubert Laitko." Leibniz intern: Mitteilungen der Leibniz-Sozietät e. V. (Nr. 27, Juni 2005): 9–10.

3 Kant, Horst and Annette Vogt, eds. *Aus Wissenschaftsgeschichte und -theorie. Hubert Laitko zum 70. Geburtstag überreicht von Freunden, Kollegen und Schülern*. Berlin: Verlag für Wissenschafts- und Regionalgeschichte Engel, 2005.

1 Kiesow, Rainer Maria and Henning Schmidgen, eds. *Das Irrsal hilft: [ein Projekt der Jungen Akademie an der Berlin-Brandenburgischen Akademie der Wissenschaften und der Deutschen Akademie der Naturforscher Leopoldina]*. Internationaler Merve-Diskurs; 266. Berlin: Merve, 2004.

Kiesow, Rainer Maria and Henning Schmidgen. "Anhang/Nachwort." In *Kritisches Wörterbuch*, eds. Rainer Maria Kiesow and Henning Schmidgen. 81–146. Berlin: Merve, 2005.

2 Kiesow, Rainer Maria and Henning Schmidgen, eds. *Kritisches Wörterbuch*. Internationaler Merve Diskurs; 273. Berlin: Merve, 2005.

Kleeberg, Bernhard *see also: Crivellari, Kleeberg et al.*

Kleeberg, Bernhard. "Die vitale Kraft der Aggression. Evolutionistische Theorien des bösen Affen 'Mensch'." In *Disziplinen des Lebens. Zwischen Anthropologie, Literatur und Politik*, eds. Ulrich Bröckling, Benjamin Bühler, Marcus Hahn, Matthias Schöning, and Manfred Weinberg. 203–222. Tübingen: Narr, 2004.

Kleeberg, Bernhard. "[Entry] 'Haeckel'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 144-145. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Kleeberg, Bernhard. "Vor der Sprache: naturalistische Konzepte objektiver Wahrnehmung." In *Die Medien der Geschichte: Historizität und Medialität in interdisziplinärer Perspektive*, eds. Fabio Crivellari, Kay Kirchmann, Marcus Sandl, and Rudolf Schlögl. 85–108. Konstanz: UVK Verlagsgesellschaft, 2004.

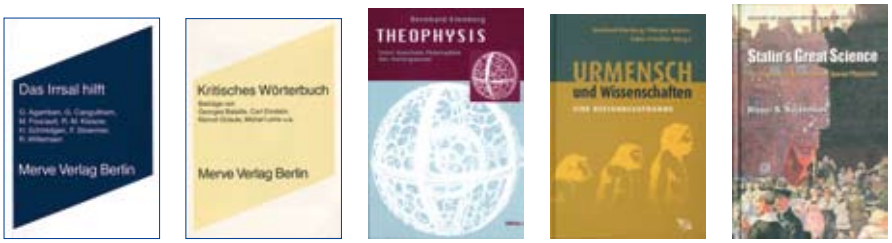
Kleeberg, Bernhard. "'Pillen drehen und Kühlschränke bauen. Vom vermeintlichen Sinn einer Meta-Entwicklungstheorie'." *Erwägen, Wissen, Ethik: EWE = Deliberation, knowledge, ethics* 16 (3 2005): 393–395.

3 Kleeberg, Bernhard. *Theophysis: Ernst Haeckels Philosophie des Naturganzen*. Köln: Böhlau, 2005.

4 Kleeberg, Bernhard, Walter Tilmann, and Fabio Crivellari, eds. *Urmensch und Wissenschaftskultur: eine Bestandsaufnahme*. Darmstadt: Wissenschaftliche Buchgesellschaft, 2005.

Klein, Ursula. "Chemical techno-science in eighteenth-century Europe." In *Research report 2002–2003*, ed. Max-Planck-Institut für Wissenschaftsgeschichte. 82–87. Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, 2004.

Klein, Ursula. "Not a pure science: chemistry in the 18th and 19th centuries." *Science* 306 (5698 2004): 981–982.



Klein, Ursula. "'Working and knowing in the history of science, technology and medicine'. Essay review of: Pickstone, John V.: Ways of knowing: a new history of science, technology and medicine. Manchester: Manchester Univ. Press 2000." *Studies in History and Philosophy of Science* 35A (1 2004): 159–172.

Klein, Ursula. "Contexts and limits of Lavoisier's analytical plant chemistry: plant materials and their classification." *Ambix* 52 (2 2005): 107–157.

Klein, Ursula. "Experimentelle Wissenschaften und Werkstättentradition." In *Homo Sapiens und Homo Faber: epistemische und technische Rationalität in Antike und Gegenwart*, eds. Gereon Wolters and Martin Carrier. 113-131. Berlin [u.a.]: de Gruyter, 2005.

Klein, Ursula. "Experiments at the intersection of experimental history, technological inquiry and conceptually driven analysis: a case study from early nineteenth-century France." *Perspectives on Science* 13 (1 2005): 1–48.

Klein, Ursula. "Introduction: Technoscientific productivity, part 1." *Perspectives on Science* 13 (2 2005): 139–141.

Klein, Ursula. "Shifting ontologies, changing classifications: plant materials from 1700 to 1830." *Studies in History an Philosophy of Science* 36A (2 2005): 261–329.

Klein, Ursula. "Technoscience avant la lettre." *Perspectives on Science* 13 (2 2005): 226–266.

Klein, Ursula. "Visualität, Ikonizität, Manipulierbarkeit: chemische Formeln als 'Paper Tools'." In *Schrift: Kulturtechnik zwischen Auge, Hand und Maschine*, eds. Gernot Grube, Werner Kogge, and Sybille Krämer. 237–252. Paderborn: Fink, 2005.

5 Kojevnikov, Alexei B. *Stalin's great science: the times and adventures of Soviet physicists*. History of modern physical sciences; 2, London: Imperial College Press, 2004.

Kolland, Dorothea, Jürgen Renn, and Henning Vierck. "Werkstatt des Wissens. Ein Ausblick." In *Künstler, Wissenschaftler, Kinder und das Nichts: ein Werkstattbericht*, eds. Jürgen Renn and Henning Vierck. 147–148. Berlin: Comenius-Garten, 2004.

Kramer, Cheryce. "Digital beasts as visual esperanto: Getty images and the colonization of sight." In *Thinking with animals: new perspectives on anthropomorphism*, eds. Lorraine Daston and Gregg Mitman. 137–171. New York: Columbia Univ. Press, 2005.

Kursell, Julia. "Le soleil a rendez-vous avec la lune. Ein Festschriftbeitrag Roman Jakobsons." In *Germano-slavistische Beiträge: Festschrift für Peter Rehder zum 65. Geburtstag*, eds. Milos Okuka and Ulrich Schweier. 439–447. München: Sagner, 2004.

Kursell, Julia and Armin Schäfer. "Das Band, das die Zeit macht." *Archiv für Mediengeschichte* 4 (2004): 45–57.

Kursell, Julia and Armin Schäfer. "Die Vermöglichung der Welt. Ilya und Emilia Kabakovs 'Palast der Projekte'." In *Projektemacher: zur Produktion von Wissen in der Vorform des Scheiterns*, ed. Markus Krajewski. 185–209. Berlin: Kulturverlag Kadmos, 2004.

Kursell, Julia and Armin Schäfer. "Klangwolken." In *Wolken*, eds. Lorenz Engell, Bernhard Siegert, and Joseph Vogl. 167–179. Weimar: Verl. der Bauhaus-Univ., 2005.

Kursell, Julia and Armin Schäfer. "Slow spaces: remarks on the music of John Cage." In *Space in America: theory, history, culture*, eds. Klaus Benesch and Kerstin Schmidt. 469–487. Amsterdam [u. a.]: Rodopi, 2005.

Lachapelle, Sofie. "Between miracle and sickness: Louise Lateau and the experience of stigmata and ecstasy." *Configurations* 12 (1 2004): 77–105.

Lachapelle, Sofie. "Attempting science: The creation and early development of the Institut métapsychique international in Paris, 1919–1931." *Journal of the History of the Behavioral Sciences* 41 (1 2005): 1–24.

Lachmund, Jens. "Mapping urban nature: bio-ecological expertise and urban planning." In *Experts in science and society*, eds. Gerd Gigerenzer and Elke Kurz-Milcke. 231–248. New York: Kluwer, 2004.

Laubichler, Manfred Dietrich and Hans-Jörg Rheinberger. "Alfred Kühn (1885 – 1968) and developmental evolution." *Journal of Experimental Zoology* 302B (2 2004): 103–110.

1 2

1 Lefèvre, Wolfgang. "The emergence of combined orthographic projections." In *Picturing machines 1400–1700*, ed. Wolfgang Lefèvre. 209–244. Cambridge, Mass. [u. a.]: MIT Press, 2004.

Lefèvre, Wolfgang. "[Entry] 'Lamarck'." In L*exikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 358-363. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Lefèvre, Wolfgang. "[Entry] 'Vicq d'Azyr'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 393. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Lefèvre, Wolfgang. "Introduction." In *Picturing machines 1400–1700*, ed. Wolfgang Lefèvre. 1–10. Cambridge, Mass. [u. a.]: MIT Press, 2004.

Lefèvre, Wolfgang, ed. *Picturing machines 1400–1700*. Transformations. Cambridge, Mass. [u. a.]: MIT Press, 2004.

Lefèvre, Wolfgang. "Science as Labor." *Perspectives on Science* 13 (2 2005): 194–225.

Lefèvre, Wolfgang and Helmut Pulte. "Widerstand: I. Naturphilosopie." In *Historisches Wörterbuch der Philosophie. Bd. 12: W–Z*, eds. Joachim Ritter, Karlfried Gründer, and Gottfried Gabriel. 703–709. Darmstadt: Wissenschaftliche Buchgesellschaft, 2005.

2 Lehmann-Brauns, Sicco. *Weisheit in der Weltgeschichte: Philosophiegeschichte zwischen Barock und Aufklärung*. Frühe Neuzeit; 99, Tübingen: Niemeyer, 2004.

Lehner, Christoph. "Einstein and the principle of general relativity, 1916–1921." In *The universe of general relativity*, eds. Anne J. Kox and Jean Eisenstaedt. 103–108. Boston [u. a.]: Birkhäuser, 2005.

1 2 3 4

Lewis, Rhodri. "A Babel off Broad Street: artificial language planning in 1650s Oxford." In *History of universities. Vol. XX/1*, ed. Mordechai Feingold. 108–145. Oxford [u. a.]: Oxford Univ. Press, 2005.

Lewis, Rhodri. "'The best mnemonicall expedient': John Beale's art of memory and its uses." *The Seventeenth Century* 20 (1 2005): 113-144.

1 Leyssen, Sigrid, Bart Vandenabeele, Kathleen Vandeputte, and Koen Vermeir, eds. *De nieuwe politieke dimensie van de kunsten*. Jaarboek voor esthetica; 2005. Budel: Damon, 2005.

2 Loza, Carmen Beatriz. *Itinerarios de Max Uhle en el Altiplano Boliviano: sus libretas de expedición e historia cultural (1893–1896)*. Indiana: Beiheft; 15, Berlin: Mann, 2004.

Loza, Carmen Beatriz. *Kallawaya: reconocimiento mundial a una ciencia de Los Andes*. La Paz: Talleres Sagitario, 2004.

Lustig, Abigail J. "Ant utopias and human dystopias around World War I." In *The moral authority of nature*, eds. Lorraine Daston and Fernando Vidal. 282–307. Chicago, Ill. [u. a.]: Univ. of Chicago Press, 2004.

3 Lustig, Abigail J. "Introduction: biologists on crusade." In *Darwinian heresies*, eds. Abigail J. Lustig, Robert J. Richards, and Michael Ruse. 1–13. Cambridge: Cambridge Univ. Press, 2004.

Lustig, Abigail J. "Natural atheology." In *Darwinian heresies*, eds. Abigail J. Lustig, Robert J. Richards, and Michael Ruse. 69–83. Cambridge: Cambridge Univ. Press, 2004.

Lustig, Abigail J., Robert J. Richards, and Michael Ruse, eds. *Darwinian heresies*. Cambridge: Cambridge Univ. Press, 2004.

Märker, Anna. "Handwerker, Wissenschaftler und die Produktion anatomischer Modelle in Florenz, 1775–1790." In *Zergliederungen – Anatomie und Wahrnehmung in der Frühen Neuzeit*, ed. Albert Schirrmeister. 101–116. Frankfurt am Main: Klostermann, 2005.

Märker, Anna. "Mechanistische Konzepte, 'virtual witnessing' und die Funktion von Öffentlichkeit in der Wohlfahrtsmaschine Rumfords." In *Figurationen des Experten: Ambivalenzen der wissenschaftlichen Expertise im ausgehenden 18. und frühen 19. Jahrhundert*, eds. Eric J. Engstrom, Volker Hess, and Ulrike Thoms. 191–208. Frankfurt am Main [u. a.]: Lang, 2005.

Märker, Anna. "Scenes from the museum: the hermaphrodite monkey and stage management at La Specola." *Endeavour* 29 (3 2005): 104–108.

Märker, Anna. "Uses and publics of the anatomical model collections of La Specola, Florence, and the Josephinum, Vienna, around 1800." In *From private to public: natural collections and museums*, ed. Marco Beretta. 81–96. Sagamore Beach, MA: Science History Publications, 2005.

Marie, Jennifer Anne. "A cultural history of heredity." *The Mendel Newsletter* 14 (2005): 15–17.

Mayer, Andreas. "[Entry] 'Freud, Sigmund (1856–1939)'." In *The social science encyclopedia*, eds. Adam Kuper and Jessica Kuper. 391–393. 3 ed., Vol. 1. London [u. a.]: Routledge, 2004.

Mayer, Andreas. "L'histoire collective de l'interprétation des rêves de Freud." *Esprit* (Novembre 2004): 108–129.

Mayer, Andreas. "Vom Werkzeugkasten zum Werk: Michel Foucaults Vorlesung über die 'psychiatrische Macht'." *Neue Rundschau* 115 (4 2004): 183–189.

Mayer, Andreas. "Autographien des Ganges: Repräsentation und Redressement bewegter Körper im neunzehnten Jahrhundert." In *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 101–138. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Mayer, Andreas. "Exposure and excitement: a short physiology of scandal." In *The naked truth: Klimt, Schiele, Kokoschka and other scandals; [Exhibition: Schirn Kunsthalle, Frankfurt, 28 January – 24 April 2005; Leopold Museum, 13 May – 22 August 2005]*, eds. Tobias G. Natter and Max Hollein. 55–66. München [u. a.]: Prestel, 2005.

4 Mayer, Andreas and Alexandre Métraux, eds. *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Mayer, Andreas and Alexandre Métraux. "Kuntmaschinen und Maschinenkunst: einführende Bemerkungen." In *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 7–23. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

McLaughlin, Peter *see: Damerow, Freudenthal, McLaughlin et al.*

McLaughlin, Peter. "Der Organismus als Analogon des Lebens." In *Hegel und das mechanistische Weltbild: vom Wissenschaftsprinzip Mechanismus zum Organismus als Vernunftbegriff*, ed. Renate Wahsner. 66–76. Frankfurt am Main [u. a.]: Lang, 2005.

McLaughlin, Peter. "Funktionen." In *Philosophie der Biologie: eine Einführung*, eds. Ulrich Krohs and Georg Toepfer. 1–15. Frankfurt am Main: Suhrkamp, 2005.

McLaughlin, Peter. "Interdisziplinaritätsgrenzen." In *Wissenschaftsphilosophie interdisziplinärer Umweltforschung*, eds. Stefan Baumgärtner and Christian Becker. 41–52. Marburg: Metropolis-Verl., 2005.

McLaughlin, Peter. "Lehren was man selber nicht weiß." In *Homo Sapiens und Homo Faber: epistemische und technische Rationalität in Antike und Gegenwart; Festschrift für Jürgen Mittelstraß*, eds. Gereon Wolters and Martin Carrier. 157–169. Berlin: de Gruyter, 2005.

McLaughlin, Peter. "Materialism, actualism, and science: what's modern about modern science?" In *Darwinism & philosophy*, eds. Vittorio Hösle and Christian Illies. 15–29. Notre Dame, Ind.: Univ. of Notre Dame Press, 2005.

Métraux, Alexandre *see also: Mayer and Métraux*

Métraux, Alexandre. "Das eidetische Pferd: wie Bertalan Székely Bildanimationen konstruierte." In *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 61–100. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Mohr, Barbara and Annette Vogt. "Erfolgsgeschichten Berliner Geowissenschaftlerinnen – alles nur Ausnahmen?" *Geohistorische Blätter* 7 (2 2004): 115–124.

Müller, Kathrin. "Formen des Anfangs. Sphärendiagramme aus dem 13. Jahrhundert." In *Diagramme und bildtextile Ordnungen*, ed. Birgit Schneider. 85–96. Berlin: Akademie Verlag, 2005.

Müller, Kathrin. "Irritierende Variabilität. Die mittelalterliche Reproduktion von Wissen im Diagramm." In *Übertragungen: Formen und Konzepte von Reproduktion in Mittelalter und Früher Neuzeit*, eds. Bettina Bussmann, Albrecht Hausmann, Annelie Kreft, and Cornelia Logemann. 415–436. Berlin [u. a.]: de Gruyter, 2005.

Müller-Wille, Staffan *see also: D. Hoffmann, Laitko and Müller-Wille*

Müller-Wille, Staffan *see also: Rheinberger and Müller-Wille*

Müller-Wille, Staffan. "Ein Anfang ohne Ende. Das Archiv der Naturgeschichte und die Geburt der Biologie." In *Macht des Wissens: die Entstehung der modernen Wissensgesellschaft*, eds. Richard van Dülmen and Sina Rauschenbach. 587–605. Köln [u. a.]: Böhlau, 2004.

Müller-Wille, Staffan. "[Entries] 'Fisher', 'Flemming', 'Gärtner', 'Hales', 'Linné', 'Loeb'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Müller-Wille, Staffan. "[Entries] 'Saunders', 'Schiemann', 'Stern, C.', 'Sturtevant', 'Sutton', 'Tschermak von Seysenegg', 'Vries', 'Wilson'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Müller-Wille, Staffan. "[Entry] 'Linnaeus, Carl'." In *Europe 1450 to 1789: Encyclopedia of the Early Modern World. Vol. 3*, ed. Jonathan Dewald. 512–513. New York [u. a.]: Scribner, 2004.

Müller-Wille, Staffan. "Eruditio historica, critica, antiqua. Quellen der Naturgeschichte." In *'Quelle': Zwischen Ursprung und Konstrukt; ein Leitbegriff in der Diskussion*, eds. Thomas Rathmann and Nikolaus Wegmann. 89–101. Berlin: Schmidt, 2004.

Müller-Wille, Staffan. "Early Mendelism and the subversion of taxonomy: epistemological obstacles as institutions." *Studies in History and Philosophy of Biological and Biomedical Sciences* 36 (3 2005): 465–487.

Müller-Wille, Staffan. "Konstellation, Serie, Formation: genealogische Denkfiguren bei Harvey, Linnaeus und Darwin." In *Generation: zur Genealogie des Konzepts – Konzepte von Genealogie*, eds. Sigrid Weigel, Ohad Parnes, Ulrike Vedder, and Stefan Willer. 215–233. München: Fink, 2005.

Müller-Wille, Staffan. "Paradies, Akademie, Ökonomie. Zur Transformation botanischer Gärten im 18. Jahrhundert." In *Der andere Garten: Erinnern und Erfinden in Gärten von Institutionen*, eds. Natascha N. Hoefer and Anna Ananieva. 235–249. Göttingen: Vandenhoeck & Ruprecht, 2005.

Müller-Wille, Staffan. "Schwarz, Weiß, Rot, Gelb: zur Darstellung menschlicher Vielfalt." In *Dingwelten: das Museum als Erkenntnisort*, eds. Anke te Heesen and Petra Lutz. 161–170. Köln [u. a.]: Böhlau, 2005.

1 2

Müller-Wille, Staffan. "Walnuts at Hudson Bay, Coral Reefs in Gotland: the colonialism of Linnaean botany." In *Colonial botany: science, commerce, and politics in the early modern world*, eds. Londa Schiebinger and Claudia Swan. 34–48. Philadelphia: Univ. of Pennsylvania Press, 2005.

Müller-Wille, Staffan. "Zum Verhältnis von Taxonomie und Genetik um 1900 – Die Zuchtstation des Schwedischen Saatzuchtvereins Svalöf." In S*tätten biologischer Forschung / Places of biological research: Beiträge zur 12. Jahrestagung DGGTB in Neapel 2003*, eds. Christiane Groeben, Joachim Kaasch, and Michael Kaasch. 203–216. Berlin: VWB – Verlag für Wissenschaft und Bildung, 2005.

1 Nissen, Hans J., Peter Damerow, and Robert K. Englund. *Informationsverarbeitung vor 5000 Jahren: frühe Schrift und Techniken der Wirtschaftsverwaltung im alten Vorderen Orient; Informationsspeicherung und -verarbeitung vor 5000 Jahren.* 2. ed., Hildesheim [u. a.]: Franzbecker, 2004.

Nobre, Sergio. "Essay review of: Dauben, Joseph W. and Christoph J. Scriba (eds.). Writing the history of mathematics: Its historical development. Basel [u. a.]: Birkhäuser 2002." *Revista Brasileira de História da Matemática* 4 (7 2004): 79–87.

Nobre, Sergio. "Isidoro de Sevilla e a história da matemática presente em sua Enciclopédia etimologias (séc. 7)." *Revista Brasileira de História da Matemática* 5 (9 2005): 37–58.

Nowacki, Horst. "Archimedes und die Stabilität schwimmender Körper." *Jahrbuch der Schiffbautechnischen Gesellschaft* 96 (2002 (publ. 2004)): 93–105.

Nowacki, Horst. "Bouguer and Euler: zur Begründung der Theorie der hydrostatischen Schiffsstabilität." *Jahrbuch der Schiffbautechnischen Gesellschaft* 99 (2005): 183–190.

Nowacki, Horst and Hyun Cheol Kim. "Form Parameter Based Design of Hull Shapes as Volume and Surface Objects." In *Proceedings of the 12th International Conference on Computer applications in shipbuilding; ICCAS <Aug. 23–26, 2005 in Busan, South Korea>*, eds. Kaj Johansson and Soonhung Han. 515–528. Seoul: Society of Naval Architects of Korea, 2005.

Otis, Laura. "[Entry] 'Romanes'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 219. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Otis, Laura. "Cells and Networks in Nineteenth Century Literature." In *Unmapped countries: biological visions in nineteenth-century literature and culture*, ed. Anne-Julia Zwierlein. 135–143. London: Anthem Press, 2005.

Perinetti, Dario. "History, concepts, and normativity in Hegel." In *Hegel's theory of the subject*, ed. David G. Carlson. 60–72. Basingstoke [u. a.]: Palgrave Macmillan, 2005.

Pickering, Andrew. "Decentering Sociology: Synthetic Dyes and Social Theory." *Perspectives on Science* 13 (3 2005): 352–405.

Pickering, Andrew. "From Dyes to Iraq: a reply to Jonathan Harwood." *Perspectives on Science* 13 (3 2005): 416–425.

Pietsch, Annik. "Gemalte Haut – ein Gewebe aus Kunst, Wissenschaft und Philosophie. Jakob Schlesingers Hegel-Porträt." *VDR-Beiträge zur Erhaltung von Kunst- und Kulturgut* (2 2005): 84–98.

Pomata, Gianna. "Praxis historalis: the uses of historia in early modern medicine." In *Historia: empiricism and erudition in early modern Europe*, eds. Gianna Pomata and Nancy G. Siraisi. 105–146. Cambridge, Mass. [u. a.]: MIT Press, 2005.

2 Pomata, Gianna and Nancy G. Siraisi, eds. *Historia: empiricism and erudition in early modern Europe*. Cambridge, Mass. [u. a.]: MIT Press, 2005.

Popplow, Marcus. "Why draw pictures of machines? The social contexts of early modern machine drawings." In *Picturing machines 1400–1700*, ed. Wolfgang Lefèvre. 17–48. Cambridge, Mass. [u. a.]: MIT Press, 2004.

Presas i Puig, Albert. "Science on the periphery. The Spanish reception of nuclear energy: An attempt at modernity?" *Minerva* 43 (2 2005): 197–218.

Ragep, F. Jamil. "Copernicus and his Islamic predecessors: some historical remarks." *Filozofski Vestnik* 25 (4 2004 (publ. 2005)): 125–142.

Ragep, F. Jamil. "'Ali Qushji and Regiomontanus: Eccentric Transformations and Copernican Revolutions." *Journal for the History of Astronomy* 36 (4 2005): 359–371.

Ratmoko, Christina. "Hormone aus dem Industrielabor: die Erforschung und Herstellung von Geschlechtshormonen bei der Ciba zwischen 1910 und 1940." *Schweizerische Zeitschrift für Geschichte* 55 (1 2005): 84–94.

1

1 Remaud, Olivier. *Les archives de l'humanité: essai sur la philosophie de Vico*. La couleur des idées, Paris: Seuil, 2004.

Renn, Jürgen *see also: Bevilacqua and Renn*

Renn, Jürgen *see also: Büttner, Damerow and Renn*

Renn, Jürgen *see also: Damerow, Freudenthal, McLaughlin and Renn*

Renn, Jürgen *see also: D. Hoffmann and Renn*

Renn, Jürgen *see also: Iglhaut and Renn*

Renn, Jürgen *see also: Kolland, Renn et al.*

Renn, Jürgen. "Adquiérela para poseerla: la herencia cultural en la era de la revolución informativa." In *Percepción social de la ciencia*, eds. Francisco José Rubia Vila, Isabel Fuentes Julián, and Santos Casado de Otaola. 233–247. Madrid: Academia Europea de Ciencias y Artes, 2004.

Renn, Jürgen. "Die herausfordernden Bilder der Artillerie: Praktisches Wissen an den Ursprüngen der wissenschaftlichen Revolution." In *Form, Zahl, Ordnung: Studien zur Wissenschafts- und Technikgeschichte; Ivo Schneider zum 65. Geburtstag*, eds. Rudolf Seising, Menso Folkerts, and Ulf Hashagen. 439–466. Stuttgart: Steiner, 2004.

Renn, Jürgen. "Die klassische Physik vom Kopf auf die Füße gestellt: Wie Einstein die Spezielle Relativitätstheorie fand." *Physik-Journal* 3 (3 2004): 49–55.

Renn, Jürgen. "Einstein im Grenzgebiet von Wissenschaft und Politik (Editorial)." *Physik in unserer Zeit* 35 (2 2004): 55.

Renn, Jürgen. "The paradox of scientific progress. Notes on the foundation of a historical theory of knowledge." In *Research report 2002–2003*, ed. Max-Planck-Institut für Wissenschaftsgeschichte. 21–49. Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, 2004.

2 3 4 5 6

Renn, Jürgen. "The relativity revolution from the perspective of historical epistemology." *Isis* 95 (4 2004 (publ. 2005)): 640–648.

Renn, Jürgen. "Wissenschaft und Journalismus: Zwei Welten, zwei Kulturen?" *Stifterverband für die Deutsche Wissenschaft* (2004): 28–37.

2 Renn, Jürgen, ed. *Albert Einstein—chief engineer of the universe: Einstein's life and work in context*. Weinheim: Wiley-VCH, 2005.

3 Renn, Jürgen, ed. *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*. Weinheim: Wiley-VCH, 2005.

4 Renn, Jürgen, ed. *Albert Einstein – Ingenieur des Universums: Dokumente eines Lebensweges*. Weinheim: Wiley-VCH, 2005.

5 Renn, Jürgen, ed. *Albert Einstein – Ingenieur des Universums: Einsteins Leben und Werk im Kontext*. Weinheim: Wiley-VCH, 2005.

6 Renn, Jürgen, ed. *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen. "Annus Mirabilis 1905 – Einsteins Wunderjahr." *Einstein und die Folgen* (2005): 12–20.

Renn, Jürgen. "Before the Riemann Tensor: The Emergence of Einstein's Double Strategy." In *The universe of general relativity*, eds. Anne J. Kox and Jean Eisenstaedt. 53–65. Boston [u.a.]: Birkhäuser, 2005.

Renn, Jürgen. "Die atomistische Revolution." *Physik-Journal* 4 (3 2005): 53–59.

Renn, Jürgen. "Einleitung: Ein grenzgängerisches Genie." *Physik-Journal* 4 (3 2005): 35–38.

Renn, Jürgen. "Einstein als Bundesgenosse." In *Der Einstein-Komplex: 99 Philosophen, Schriftsteller, Künstler und Wissenschaftler über ein Genie*, eds. Gerd Weiberg and Frank Berberich. 16. Heidelberg: Verlag Das Wunderhorn, 2005.

1 2

Renn, Jürgen. "Einstein und das Paradox des wissenschaftlichen Fortschritts: Wie aus überlieferten Erkenntnissen Neues entstehen kann." *Neue Zürcher Zeitung: NZZ, Internationale Ausgabe*, 16.03.2005, 63.

Renn, Jürgen. "Einstein, Hilbert und der geheimnisvolle Schnipsel." *Frankfurter Allgemeine Sonntagszeitung*, 20.11.2005, 76–77.

Renn, Jürgen. "Einstein: il primato della scienza." *Il Giornale di Socrate al Caffè* (40 2005): 10–11.

1 Renn, Jürgen, ed. *Einstein's Annalen papers: the complete collection 1901–1922*. Annalen der Physik; 14, Suppl. 3–8 (2005). Berlin [u. a.]: Wiley-VCH, 2005.

Renn, Jürgen. "Einstein's invention of Brownian motion." In *Einstein's Annalen papers: the complete collection 1901–1922*, ed. Jürgen Renn. 23–37. Berlin [u. a.]: Wiley-VCH, 2005.

Renn, Jürgen. "Geleitwort." In *Albert Einstein: Akademie-Vorträge; Sitzungsberichte der Preußischen Akademie der Wissenschaften 1914–1932*, ed. Dieter Simon. V–VIII. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen. "How Einstein Became a Politician." In *Einstein—peace now!*, eds. Reiner Braun and David Krieger. 17–19. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen. "Introduction." In *Einstein's Annalen papers: the complete collection 1901–1922*, ed. Jürgen Renn. 9–14. Berlin [u. a.]: Wiley-VCH, 2005.

Renn, Jürgen. "Preface." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 10–11. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen. "Standing on the shoulders of a dwarf: general relativity— a triumph of Einstein and Grossmann's Erroneous Entwurf Theory." In *The universe of general relativity*, eds. Anne J. Kox and Jean Eisenstaedt. 39–51. Boston [u. a.]: Birkhäuser, 2005.

Renn, Jürgen. "Vorwort." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 10–11. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen. "War Einstein allein?" *Süddeutsche Zeitung*, 03.01.2005, 16.

Renn, Jürgen. "Wie aus Albert Einstein wurde." *Der Tagesspiegel*, 20.01.2005, 28–29.

2 Renn, Jürgen. *Wie Einstein die Relativitätstheorie entdeckte*. Reden und Aufsätze der Universität Ulm; 12. Ulm: Univ., 2005.

Renn, Jürgen. "Wie Einstein zum Politiker wurde." *Blickpunkt Bundestag* (2 2005): 3.

Renn, Jürgen. "Wie Einstein zum Politiker wurde." In *Albert Einstein – Frieden heute: Visionen und Ideen*, eds. Reiner Braun and David Krieger. 27–29. Neu-Isenburg: Melzer, 2005.

Renn, Jürgen. "Wissenschaft als Lebensorientierung: eine Erfolgsgeschichte?" In *Leben: Verständnis, Wissenschaft, Technik; Kongreßband des XI. Europäischen Kongresses für Theologie, 15.–19. September 2002 in Zürich*, ed. Eilert Herms. 15–31. Gütersloh: Gütersloher Verlagshaus, 2005.

Renn, Jürgen and Dieter Hoffmann. "1905—a miraculous year." *Journal of Physics B: Atomic, Molecular and Optical Physics* 38 (9 2005): S437–S448.

Renn, Jürgen and Ulf von Rauchhaupt. "Im Labor des Wissens." *Frankfurter Allgemeine Sonntagszeitung*, 09.01.2005, 58–59.

Renn, Jürgen and Ulf von Rauchhaupt. "Im Labor des Wissens." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 26–33. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen and Ulf von Rauchhaupt. "In the laboratory of knowledge." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 26–33. Weinheim: Wiley-VCH, 2005.

Renn, Jürgen and Ulf von Rauchhaupt. "Nel laboratorio della conoscenza." In *Albert Einstein: ingegnere dell'universo*, eds. Fabio Bevilacqua and Jürgen Renn. 16–19. Milano: Skira, 2005.

Renn, Jürgen and Tilman Sauer. "Im Rampenlicht der Sterne: Einstein, Mandl, und die Ursprünge der Gravitationslinsenforschung." In *Einsteins Kosmos: Untersuchungen zur Geschichte der Kosmologie, Relativitätstheorie und zu Einsteins Wirken und Nachwirken*, eds. Hilmar W. Duerbeck and Wolfgang R. Dick. 210–239. Frankfurt am Main: Deutsch, 2005.

1

1 Renn, Jürgen and Henning Vierck, eds. *Künstler, Wissenschaftler, Kinder und das Nichts: ein Werkstattbericht*. Berlin: Comenius-Garten, 2004.

Rentetzi, Maria. "The city as a context of scientific activity: creating the Mediziner-Viertel in fin-de-siecle Vienna." *Endeavour* 28 (1 2004): 39–44.

Rentetzi, Maria. "Gender, politics, and radioactivity research in interwar Vienna: the case of the Institute for Radium Research." *Isis* 95 (3 2004): 359–393.

Rentetzi, Maria. "The women radium dial painters as experimental subjects (1920–1990) or what counts as human experimentation." *NTM* N.S. 12 (4 2004): 233–248.

Rentetzi, Maria. "Designing (for) a new scientific discipline: the location and architecture of the Institut für Radiumforschung in early twentieth-century Vienna." *British Journal for the History of Science* 38 (3 2005): 275–306.

Rheinberger, Hans-Jörg *see also: Gaudillière and Rheinberger*

Rheinberger, Hans-Jörg *see also: Hörisch, Reemtsma, Lüthje, Zimmerli and Rheinberger*

Rheinberger, Hans-Jörg *see also: Hucho, Brockhoff, Daele, Köchy, Reich, Rheinberger et al.*

Rheinberger, Hans-Jörg *see also: Laubichler and Rheinberger*

Rheinberger, Hans-Jörg *see also: Schmidgen and Rheinberger*

Rheinberger, Hans-Jörg. "Carl Correns and the early history of genetic linkage." In *Classical genetic research and its legacy: the mapping cultures of twentieth-century genetics*, eds. Hans-Jörg Rheinberger and Jean-Paul Gaudillière. 21–33. London: Routledge, 2004.

Rheinberger, Hans-Jörg. "Commentary 'Physics and chemistry of life'." In *The science-industry nexus: history, policy, implications: Nobel Symposium 123*, eds. Karl Grandin, Nina Wormbs, and Sven Widmalm. 221–225. Sagamore Beach, MA: Science History Publications, 2004.

Rheinberger, Hans-Jörg. "Die Wissenschaft des Konkreten." In *Das wilde Denken*, eds. Norbert Haas, Rainer Nägele, and Hans-Jörg Rheinberger. 55–71. Eggingen: Isele, 2004.

Rheinberger, Hans-Jörg. "Die Zusammenarbeit zwischen Adolf Butenandt und Alfred Kühn." In *Adolf Butenandt und die Kaiser-Wilhelm-Gesellschaft: Wissenschaft, Industrie und Polititk im 'Dritten Reich'*, eds. Wolfgang Schieder and Achim Trunk. 169–197. Göttingen: Wallstein, 2004.

Rheinberger, Hans-Jörg. "[Entries] 'Crick' , 'Jacob', 'Molekularbiologie', 'Monod', 'Nirenberg', 'Watson'." In *Enzyklopädie Medizingeschichte*, eds. Werner E. Gerabek, Bernhard D. Haage, Gundolf Keil, and Wolfgang Wegner. Berlin [u. a.]: de Gruyter, 2004.

Rheinberger, Hans-Jörg. "[Entries] 'Kühn', 'McClintock'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Rheinberger, Hans-Jörg. "Gaston Bachelard und der Begriff der 'Phänomenotechnik'." In '*... immer im Forschen bleiben*': *Rüdiger vom Bruch zum 60. Geburtstag*, eds. Marc Schalenberg and Peter T. Walther. 297-310. Stuttgart: Steiner, 2004.

Rheinberger, Hans-Jörg. "A history of protein biosynthesis and ribosome research." In *Protein synthesis and ribosome structure. Translating the genome*, eds. Knud H. Nierhaus and Daniel N. Wilson. 1–51. Weinheim: Wiley-VCH, 2004.

Rheinberger, Hans-Jörg. "Intersections. Some thoughts on instruments and objects in the experimental context of the life sciences." In *Research report 2002–2003*, ed. Max-Planck-Institut für Wissenschaftsgeschichte. 69–81. Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, 2004.

Rheinberger, Hans-Jörg. "Wozu Wissenschaftsgeschichte?" In *Form, Zahl, Ordnung: Studien zur Wissenschafts- und Technikgeschichte; Ivo Schneider zum 65. Geburtstag*, eds. Rudolf Seising, Menso Folkerts, and Ulf Hashagen. 51–62. Stuttgart: Steiner, 2004.

Rheinberger, Hans-Jörg. "Writing works: A reaction to Michael Cahn's paper." In *History of science, history of text*, ed. Karine Chemla. 95–103. Dordrecht: Springer, 2004.

Rheinberger, Hans-Jörg. "Ein erneuter Blick auf die historische Epistemologie von Georges Canguilhem." In *Maß und Eigensinn: Studien im Anschluß an Georges Canguilhem*, eds. Cornelius Borck, Volker Hess, and Henning Schmidgen. 223–237. München: Fink, 2005.

Rheinberger, Hans-Jörg. "Eine Randnotiz zur Repräsentation von Generationen in Mendels Vererbungslehre." In *Generation: zur Genealogie des Konzepts – Konzepte von Genealogie*, eds. Sigrid Weigel, Ohad Parnes, Ulrike Vedder, and Stefan Willer. 261–266. München: Fink, 2005.

Rheinberger, Hans-Jörg. "Epistemologica: Präparate." In *Dingwelten: das Museum als Erkenntnisort*, eds. Anke te Heesen and Petra Lutz. 65–75. Köln [u. a.]: Böhlau, 2005.

Rheinberger, Hans-Jörg. "Ernest F. Gale and proteine synthesis: the difficulties of analysing a complex system." In *The inside story: DNA to RNA to protein; readings from trends in biochemical sciences*, ed. Jan A. Witkowski. 161–169. New York: Cold Spring Harbor Laboratory Press, 2005.

Rheinberger, Hans-Jörg. "Gaston Bachelard and the notion of 'phenomenotechnique'." *Perspectives on Science* 13 (3 2005): 313–328.

Rheinberger, Hans-Jörg. *Iterationen*. Berlin: Merve, 2005.

Rheinberger, Hans-Jörg. "Kritzel und Schnipsel." In *'fülle der combination': Literaturforschung und Wissenschaftsgeschichte*, eds. Bernhard J. Dotzler and Sigrid Weigel. 343–356. München: Fink, 2005.

Rheinberger, Hans-Jörg. "Ludwik Fleck und die Historizität wissenschaftlichen Wissens." In *Tatsache – Denkstil – Kontroverse: Auseinandersetzungen mit Ludwik Fleck*, ed. Rainer Egloff. 29–31. Zürich: Collegium Helveticum, 2005.

Rheinberger, Hans-Jörg. "Nachschrift." In *Kunstmaschinen: Spielräume des Sehens zwischen Wissenschaft und Ästhetik*, eds. Andreas Mayer and Alexandre Métraux. 203–213. Frankfurt am Main: Fischer Taschenbuch Verlag, 2005.

Rheinberger, Hans-Jörg. "Nichtverstehen und Forschen." In *Kultur Nicht Verstehen: Produktives Nichtverstehen und Verstehen als Gestaltung*, eds. Juerg Albrecht, Jörg Huber, Kornelia Imesch, Karl Jost, and Philipp Stoellger. 75–81. Zürich: Ed. Voldemeer, 2005.

Rheinberger, Hans-Jörg. "Protozoologie, Fortpflanzung, Befruchtung: Max Hartmanns Experimente zur Regulation und seine Allgemeine Biologie." In *Physica et historia: Festschrift für Andreas Kleinert zum 65. Geburtstag*, eds. Susan Splinter, Sybille Gerstengarbe, Horst Remane, and Benno Parthier. 295–306. Stuttgart: Wissenschaftliche Verlagsgesellschaft, 2005.

1 2

Rheinberger, Hans-Jörg. "Reassessing the historical epistemology of Georges Canguilhem." In *Continental philosophy of science*, ed. Gary Gutting. 187–197. Malden, MA [u. a.]: Blackwell, 2005.

Rheinberger, Hans-Jörg. "A reply to David Bloor: 'Toward a sociology of epistemic things'." *Perspectives on Science* 13 (3 2005): 406–410.

Rheinberger, Hans-Jörg. "Überlegungen zum Begriff des Modellorganismus in der biologischen und medizinischen Forschung." In *Modelle des Denkens: Streitgespräch in der Wissenschaftlichen Sitzung der Versammlung der Berlin-Brandenburgischen Akademie der Wissenschaften am 12. Dezember 2003*, 69–74. Berlin: Berlin-Brandenburgische Akademie der Wissenschaften, 2005.

Rheinberger, Hans-Jörg. "Überlegungen zur Kultur der Naturwissenschaften und zur Natur der Geisteswissenschaften." In *Geisteswissenschaften – wozu?: eine Reihe mit Vorträgen*, eds. Jochen Hörisch, Jan Phillip Reemtsma, Jürgen Lüthje, Walter Ch. Zimmerli, and Hans-Jörg Rheinberger. 97–111. Hamburg: Freie Akademie der Künste, 2005.

Rheinberger, Hans-Jörg. "Welches Volk hat die besten Gene?" In *Evolution: Wege des Lebens: [anläßlich der Ausstellung 'Evolution, Wege des Lebens', Deutsches Hygiene-Museum Dresden, 24. September 2005 bis 23. Juli 2006]*, ed. Johann Grolle. 194–202. München [u. a.]: Deutsche Verlags-Anstalt, 2005.

Rheinberger, Hans-Jörg and Jean-Paul Gaudillière, eds. *Classical genetic research and its legacy: the mapping cultures of twentieth-century genetics*. Routledge studies in the history of science, technology and medicine; 19. London: Routledge, 2004.

1 Rheinberger, Hans-Jörg and Jean-Paul Gaudillière. "Introduction." In *Classical genetic research and its legacy: the mapping cultures of twentieth-century genetics*, eds. Hans-Jörg Rheinberger and Jean-Paul Gaudillière. 1–5. London: Routledge, 2004.

2 Rheinberger, Hans-Jörg, Norbert Haas, and Rainer Nägele, eds. *Das wilde Denken*. Liechtensteiner Exkurse; 5. Eggingen: Isele, 2004.

Rheinberger, Hans-Jörg, Norbert Haas, and Rainer Nägele. "Vorwort." In *Das wilde Denken*, eds. Norbert Haas, Rainer Nägele, and Hans-Jörg Rheinberger. 7–8. Eggingen: Isele, 2004.

Rheinberger, Hans-Jörg and Staffan Müller-Wille. "[Entry] 'Gene'." In *Stanford encyclopedia of philosophy*, 2004: http://plato.stanford.edu/contents.html

Ritter, Jim. "Reading Strasbourg 368: A thrice-told tale." In *History of science, history of text*, ed. Karine Chemla. 177-200. Dordrecht: Springer, 2004.

Schaffer, Simon and Larry Stewart. "Vigani and after: chemical enterprise in Cambridge 1680–1780." In *The 1702 chair of chemistry at Cambridge: transformation and change*, eds. Mary Archer and Christopher Haley. 31–56. Cambridge [u. a.]: Cambridge Univ. Press, 2005.

Schemmel, Matthias. "An astronomical road to general relativity: the continuity between classical and relativistic cosmology in the work of Karl Schwarzschild." *Science in Context* 18 (3 2005): 451–478.

Schemmel, Matthias. "Curved universes before Einstein: Karl Schwarzschild's cosmological speculations." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 90–93. Weinheim: Wiley-VCH, 2005.

Schemmel, Matthias. "Gekrümmte Universen vor Einstein: Karl Schwarzschilds kosmologische Spekulationen." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 90–93. Weinheim: Wiley-VCH, 2005.

Schemmel, Matthias. "Gekrümmte Universen vor Einstein: Karl Schwarzschilds kosmologische Spekulationen und die Anfänge der relativistischen Kosmologie." In *Einsteins Kosmos: Untersuchungen zur Geschichte der Kosmologie, Relativitätstheorie und zu Einsteins Wirken und Nachwirken*, eds. Hilmar W. Duerbeck and Wolfgang R. Dick. 56–65. Frankfurt am Main: Deutsch, 2005.

1 Schiebinger, Londa. *Plants and empire: colonial bioprospecting in the Atlantic world*. Cambridge, Mass. [u. a.]: Harvard Univ. Press, 2004.

Schiebinger, Londa. "Prospecting for drugs: European naturalists in the West Indies." In *Colonial botany: science, commerce, and politics in the early modern world*, eds. Londa Schiebinger and Claudia Swan. 119–133. Philadelphia: Univ. of Pennsylvania Press, 2005.

2 Schiebinger, Londa and Claudia Swan, eds. *Colonial botany: science, commerce, and politics in the early modern world*. Philadelphia: Univ. of Pennsylvania Press, 2005.

1 2 3 4

Schiebinger, Londa and Claudia Swan. "Introduction." In *Colonial botany: science, commerce, and politics in the early modern world*, eds. Londa Schiebinger and Claudia Swan. 1–16. Philadelphia: Univ. of Pennsylvania Press, 2005.

Schiefsky, Mark J. *Hippocrates on ancient medicine*. Leiden [u. a.]: Brill, 2005.

Schiefsky, Mark J. "Technical terminology in Greco-Roman treatises on artillery construction." In *Antike Fachtexte*, ed. Thorsten Fögen. 253–270. Berlin [u. a.]: de Gruyter, 2005.

Schirrmeister, Albert. "Die zwei Leben des Heinrich Glarean: Hof, Universität und die Identität eines Humanisten." In *Humanisten am Oberrhein: neue Gelehrte im Dienst alter Herren*, eds. Sven Lembke and Markus Müller. 237–254. Leinfelden-Echterdingen: DRW-Verlag, 2004.

Schirrmeister, Albert. "Johan Huizingas Homo ludens: Kulturgeschichte, Kulturkritik und Kultur als Aufgabe." In *De-Marginalisierungen: Geschenkschrift für Gisela Engel zum 60. Geburtstag*, eds. Albert Schirrmeister, Nicole Karafyllis, Tobias Krohmer, Änne Söll, and Astrid Wilkens. 11–26. Berlin: trafo, 2004.

3 Schirrmeister, Albert, ed. *Zergliederungen – Anatomie und Wahrnehmung in der Frühen Neuzeit*. Zeitsprünge: Forschungen zur Frühen Neuzeit; 9, 1/2. Frankfurt am Main: Klostermann, 2005.

4 Schirrmeister, Albert, Nicole Karafyllis, Tobias Krohmer, Änne Söll, and Astrid Wilkens, eds. *De-Marginalisierungen: Geschenkschrift für Gisela Engel zum 60. Geburtstag*. Berlin: trafo, 2004.

Schmidgen, Henning *see also: Borck, Hess and Schmidgen*

Schmidgen, Henning *see also: Carroy and Schmidgen*

Schmidgen, Henning *see also: Kiesow and Schmidgen*

Schmidgen, Henning. "Der Mensch als störendes Tier: Über psychophysiologische Zeitexperimente, 1850–1890." In *Tiere: eine andere Anthropologie*, eds. Hartmut

Böhme, Franz-Theo Gottwald, Christoph Holtorf, Thomas Macho, Ludger Schwarte, and Christoph Wulff. 251–265. Köln [u.a]: Böhlau, 2004.

Schmidgen, Henning. "Die Geschwindigkeit von Gefühlen und Gedanken." *NTM* N.S. 12 (2 2004): 100–115.

Schmidgen, Henning. "[Entries] 'Verworn', 'Wundt'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Schmidgen, Henning. "Hörbare Experimente." In *Klaus Weber: Unfold! You cul de sac*, eds. Klaus Weber and Clemens Krümmel. 65–73. Frankfurt am Main: Revolver, 2004.

Schmidgen, Henning. "Lacan in translation." In *Das Irrsal hilft: [ein Projekt der Jungen Akademie an der Berlin-Brandenburgischen Akademie der Wissenschaften und der Deutschen Akademie der Naturforscher Leopoldina]*, eds. Rainer Maria Kiesow and Henning Schmidgen. 63–77. Berlin: Merve, 2004.

Schmidgen, Henning. "Pictures, preparations, and living processes: the production of immediate visual perception (Anschauung) in late-19th-century physiology." *Journal of the History of Biology* 37 (3 2004): 477–513.

Schmidgen, Henning. "Telegraphie, Zeit und Lärm: über die stabile Umgebung von Reaktionsversuchen." In *Kultur im Experiment*, eds. Henning Schmidgen, Peter Geimer, and Sven Dierig. 270–306. Berlin: Kulturverlag Kadmos, 2004.

Schmidgen, Henning. "Zeit als peripheres Zentrum: Psychologie und Kybernetik." In *Cybernetics: the Macy conferences 1946–1953. Bd. 2: Essays and documents*, ed. Claus Pias. 131–152. Berlin [u. a.]: Diaphanes, 2004.

Schmidgen, Henning. "Zeit der Fugen: über Bewegungsverhältnisse im physiologischen Labor, ca. 1865." In *Zeithorizonte in der Wissenschaft*, ed. Dieter Simon. 101–124. Berlin: de Gruyter, 2004.

Schmidgen, Henning. "Camera silenta. Über Organlosigkeit in Zeitexperimenten um 1900." In *'fülle der combination': Literaturforschung und Wissenschaftsgeschichte*, eds. Bernhard J. Dotzler and Sigrid Weigel. 51–74. München: Fink, 2005.

1 Schmidgen, Henning, ed. *Canguilhem, Georges: Gesundheit – eine Frage der Philosophie*. Berlin: Merve, 2005.

Schmidgen, Henning. "Das Experimentelle und das Pathologische: zur Geschichte psychophysiologischer Zeitmessungen, 1880–1900." In *Maß und Eigensinn: Studien*

1 2 3

im Anschluß an Georges Canguilhem, eds. Cornelius Borck, Volker Hess, and Henning Schmidgen. 197–219. München: Fink, 2005.

Schmidgen, Henning. "Die Donders-Maschine. Ein Kapitel Physiologiegeschichte mit Deleuze und Guattari." In *Lebendige Zeit: Wissenskulturen im Werden*, ed. Henning Schmidgen. 242–279. Berlin: Kulturverlag Kadmos, 2005.

Schmidgen, Henning. "Einleitung." In *Lebendige Zeit: Wissenskulturen im Werden*, ed. Henning Schmidgen. 7–14. Berlin: Kulturverlag Kadmos, 2005.

2 Schmidgen, Henning, ed. *Lebendige Zeit: Wissenskulturen im Werden*. Berlin: Kulturverlag Kadmos, 2005.

Schmidgen, Henning. "Physics, ballistics, and psychology: A history of the chronoscope in/as context, 1845–1890." *History of Psychology* 8 (1 2005): 46–78.

Schmidgen, Henning. "Repetition and differences: psychophysiological time machines, 1850–1865." In *Variantology 1: on deep time relations of arts, sciences and technologies*, eds. Siegfried Zielinski and Silvia M. Wagnermaier. 145–158. Köln: Verlag der Buchhandlung Walther König, 2005.

Schmidgen, Henning, Peter Geimer, and Sven Dierig, eds. *Kultur im Experiment*. Berlin: Kulturverlag Kadmos, 2004.

3 Schmidgen, Henning, Peter Geimer, and Sven Dierig. "Einleitung." In *Kultur im Experiment*, eds. Henning Schmidgen, Peter Geimer, and Sven Dierig. 7–14. Berlin: Kulturverlag Kadmos, 2004.

Schmidgen, Henning and Hans-Jörg Rheinberger. "Circulations: a virtual laboratory and its elements." In *Making things public: atmospheres of democracy*, eds. Bruno Latour and Peter Weibel. 320–325. Cambridge, Mass. [u. a.]: MIT Press [u. a.], 2005.

Schneider, Hans Julius and Elke Franke-Heubach. "[Entries] 'Abul Wafa', 'Abubacer', 'Alfraganus', 'Alhazen'." In *Enzyklopädie Philosophie und Wissenschaftstheorie. Bd. 1*, eds. Jürgen Mittelstraß and Martin Carrier. 2. neubearb. und wesentl. erg. Aufl., Stuttgart [u. a.]: Metzler, 2005.

1 2

Schröder, Iris. "Die Erde im Archiv: Das Projekt einer Humangeographie in Bildern, 1911-1931." In *Welt-Räume: Geschichte, Geographie und Globalisierung seit 1900*, eds. Iris Schröder and Sabine Höhler. 100–119. Frankfurt a. M. [u. a.]: Campus-Verl., 2005.

Schröder, Iris and Sabine Höhler. "Für eine Geschichte der Räume und Orte im globalen Zeitalter." In *Welt-Räume: Geschichte, Geographie und Globalisierung seit 1900*, eds. Iris Schröder and Sabine Höhler. 303–313. Frankfurt a. M. [u. a.]: Campus-Verl., 2005.

Schröder, Iris and Sabine Höhler. "Vorwort." In *Welt-Räume: Geschichte, Geographie und Globalisierung seit 1900*, eds. Iris Schröder and Sabine Höhler. 7–8. Frankfurt a. M. [u. a.]: Campus-Verl., 2005.

1 Schröder, Iris and Sabine Höhler, eds. *Welt-Räume: Geschichte, Geographie und Globalisierung seit 1900*. Campus Historische Studien; 39. Frankfurt a. M. [u. a.]: Campus, 2005.

Schröder, Iris and Sabine Höhler. "Welt-Räume: Annäherung an eine Geschichte der Globalität im 20. Jahrhundert." In *Welt-Räume: Geschichte, Geographie und Globalisierung seit 1900*, eds. Iris Schröder and Sabine Höhler. 9–47. Frankfurt a. M. [u. a.]: Campus, 2005.

Schüller, Volkmar. "[Entries] 'Gassendi', 'Kepler'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 304–309. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Schüller, Volkmar. "Newton's worldview." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 98–103. Weinheim: Wiley-VCH, 2005.

Schüller, Volkmar. "Newtons Weltbild." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 98–103. Weinheim: Wiley-VCH, 2005.

Schüring, Michael. "Ein Herr aus Tübingen: Georg Melchers in den wissenschaftspolitischen Konflikten der Nachkriegszeit." In '*... immer im Forschen bleiben': Rüdiger vom Bruch zum 60. Geburtstag*, eds. Marc Schalenberg and Peter T. Walther. 373–389. Stuttgart: Steiner, 2004.

Schüring, Michael. "Albert Einstein and his fellow expells from the Kaiser Wilhelm Society." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 324–327. Weinheim: Wiley-VCH, 2005.

Schüring, Michael. "Albert Einstein und die vertriebenen Kollegen aus der Kaiser-Wilhelm-Gesellschaft." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 324–327. Weinheim: Wiley-VCH, 2005.

Schüring, Michael and Milena Wazeck. "Der Weltweise." *Spektrum der Wissenschaft Spezial: Einstein und die Folgen* (1 2005): 22–23.

Schwerin, Alexander von *see: Baader, Lederer, Low, Schmaltz and Schwerin*

Seth, Suman. "Quantum theory and the electromagnetic world-view." *Historical Studies in the Physical and Biological Sciences* 35 (1 2004): 67–93.

Sibum, H. Otto. "[Entry] 'Dancer'." In *The dictionary of nineteenth-century British scientists. Vol. 2: D–J*, ed. Bernard Lightman. 528-529. Bristol: Thoemmes Continuum, 2004.

Sibum, H. Otto. "Experience—experiment. The changing experiential basis of physics." In *Research report 2002–2003*, ed. Max-Planck-Institut für Wissenschaftsgeschichte. 88–97. Berlin: Max-Planck-Institut für Wissenschaftsgeschichte, 2004.

Sibum, H. Otto. "What kind of science is biology?" *Science* 308 (5719 2004): 201–201.

Sibum, H. Otto. "What kind of science is experimental physics?" *Science* 306 (5693 2004): 60–61.

Sibum, H. Otto. "Handwerksgelehrte oder Was für eine Wissenschaft ist Experimentalphysik?" *Jahrbuch der Max-Planck-Gesellschaft* (2005): 661–667.

Sibum, H. Otto. "Wissen aus erster Hand. Mikro-Dynamik wissenschaftlichen Wandels im frühviktorianischen England." *Historische Anthropologie* 13 (3 2005): 301–324.

2 Simon, Jonathan, ed. *Chemistry, pharmacy and revolution in France*, 1777–1809. Aldershot [u. a.]: Ashgate, 2005.

Siraisi, Nancy G. *see: Pomata and Siraisi*

Slater, Leo B. "Malaria chemotherapy and the 'kaleidoscopic' organisation of biomedical research during World War II." *Ambix* 51 (2 2004): 107–134.

Snyder, Joel. "Res ipsa loquitur." In *Things that talk: object lessons from art and science*, ed. Lorraine Daston. 195–221. New York: Zone Books, 2004.

Staley, Richard. "[Entries] 'Heitler'; 'Massey'; 'Born'." In *Oxford dictionary of national biography*, eds. Brian Harrison and Henry C. G. Matthew. Oxford: Oxford Univ. Press, 2004.

Steinle, Friedrich. "Einleitung: Michael Faraday und seine 'Experimental researches in electricity'." In *Experimental-Untersuchungen über Elektricität von Michael Faraday, in drei Bänden. Bd. 1*, ed. Michael Faraday. IV–XXXIII. Frankfurt am Main: Deutsch, 2004.

Steinle, Friedrich. "[Entry] 'Savart'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. 247. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Steinle, Friedrich. "[Essay] 'Faraday', 'Malus'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Steinle, Friedrich. "Exploratives Experimentieren. Charles Dufay und die Entdeckung der zwei Elektrizitäten." *Physik-Journal* 3 (6 2004): 47.

Steinle, Friedrich. "Romantikus kisérletezés? Esettanulmány az elektromosságról." In *Tudás az idöben*, eds. Marta Fehér, Gabor Zemplén, and Benedek Láng. 91–107. Budapest: BME Filozófia-Tudtört. Tansz., 2004.

Steinle, Friedrich. "Wissen, Technik, Macht. Elektrizität im 18. Jahrhundert." In *Macht des Wissens: die Entstehung der modernen Wissensgesellschaft*, eds. Richard van Dülmen and Sina Rauschenbach. 515–537. Köln [u. a.]: Böhlau, 2004.

Steinle, Friedrich. "Experiment and concept formation." In *Logic, methodology and philosophy of science: proceedings of the twelfth international congress <2003, Oviedo>*, eds. Petr Hájek, Luis Valdés-Villanueva, and Dag Westerstahl. 521–536. London: King's College Publ., 2005.

1 Steinle, Friedrich. Explorative Experimente: Ampère, Faraday und die Ursprünge der Elektrodynamik. Boethius; 50, Stuttgart: Steiner, 2005.

Stewart, Larry *see also: Jacob and Stewart*

1

Stewart, Larry *see: Schaffer and Stewart*

Stewart, Larry. "La buona e non mascherata filosofia or: the exhibitionists." In *Creating connections: museums and the public understanding of current research*, eds. David Chittenden, Graham Farmelo, and Bruce V. Lewenstein. 29–46. Walnut Creek, Calif. [u. a.]: AltaMira Press, 2004.

Stewart, Larry. "The public culture of radical philosophers in eighteenth-century London." In *Science and dissent in England 1688–1945*, ed. Paul Wood. 113–129. Aldershot [u. a.]: Ashgate, 2004.

Stewart, Larry. "Science and the eighteenth-century public. Scientific revolutions and the changing format of scientific investigation." In *The enlightenment world*, eds. Martin Fitzpatrick, Peter Jones, Christa Knellwolf, and Iain McCalman. 234–246. London [u. a.]: Routledge, 2004.

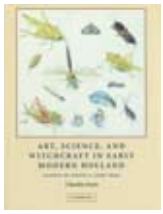
Stewart, Larry. "The trouble with Newton in the eighteenth century." In *Newton and Newtonianism: new studies*, eds. James E . Force and Sarah Hutton. 221–237. Dordrecht [u. a.]: Kluwer, 2004.

Stoff, Heiko. "Ewige Jugend und Schönheit: veraltete und verjüngte Körper zu Beginn des 20. Jahrhunderts." In *Utopische Körper: Visionen künftiger Körper in Geschichte, Kunst und Gesellschaft*, eds. Kristiane Hasselmann, Sandra Schmidt, and Cornelia Zumbusch. 41–60. München: Fink, 2004.

Stolzenberg, Daniel. "Four trees, some amulets, and the seventy-two names of God. Kircher reveals the Kabbalah." In *Athanasius Kircher: the last man who knew everything*, ed. Paula Findlen. 149–169. London: Routledge, 2004.

Stolzenberg, Daniel. "Oedipus censored: Censurae of Athanasius Kircher's works in the Archivum Romanum Societatis Iesu." *Archivum Historicum Societatis Iesu* 73 (145 2004): 3–52.

Sturm, Thomas and Mitchell G. Ash. "The roles of instruments in psychological research." *History of Psychology* 8 (2005): 3–34.



1 2

1 Sturm, Thomas, Wolfgang Carl, and Lorraine Daston. "Introduction." In *Why does history matter to philosophy and the sciences? Selected essays [by Lorenz Krüger]*, eds. Thomas Sturm, Wolfgang Carl, and Lorraine Daston. 1–17. Berlin [u. a.]: de Gruyter, 2005.

Sturm, Thomas, Wolfgang Carl, and Lorraine Daston, eds. *Why does history matter to philosophy and the sciences? Selected essays [by Lorenz Krüger]*. Berlin [u. a.]: de Gruyter, 2005.

Swan, Claudia *see also: Schiebinger and Swan*

Swan, Claudia. "Diagnosing and representing witchcraft: Medico-philosophical theories of the imagination in the context of image theory and artistic practice in the Netherlands ca. 1600." In *Sexualität und Imagination: Pathologien der Einbildungskraft im medizinischen Diskurs der frühen Neuzeit*, eds. Stefanie Zaun, Daniela Watzke, and Jörn Steigerwald. 59–82. Frankfurt am Main: Klostermann, 2004.

2 Swan, Claudia. *Art, Science, and Witchcraft in Early Modern Holland: Jacques de Gheyn II (1565–1629)*. New York: Cambridge Univ. Press, 2005.

Swan, Claudia. "Collecting naturalia in the shadow of early modern Dutch trade." In *Colonial botany: science, commerce, and politics in the early modern world*, eds. Londa Schiebinger and Claudia Swan. 223–236. Philadelphia: Univ. of Pennsylvania Press, 2005.

Tresch, John. "Cosmogram." In *Cosmogram*, eds. Melik Ohanian and Jean Christophe Royoux. 67–76. New York: Lukas & Sternberg, 2005.

Tresch, John. "¡Viva la República Cósmica!, or The Children of Humboldt and Coca-Cola." In *Making things public: atmospheres of democracy*, eds. Bruno Latour and Peter Weibel. 352–357. Cambridge, Mass. [u. a.]: MIT Press [u. a.], 2005.

Vermeir, Koen *see also: Leyssen, Vandeputte, Vandenbeele and Vermeir*

Vermeir, Koen. "Een nieuwe dimensie voor kunst en politiek?" In *De nieuwe politieke dimensie van de kunsten*, eds. Sigrid Leyssen, Bart Vandenabeele, Kathleen Vandeputte, and Koen Vermeir. 5–24. Budel: Damon, 2005.

Vermeir, Koen. "The magic of the magic lantern (1660–1700): on analogical demonstration and the visualization of the invisible." *The British Journal for the History of Science* 38 (2 2005): 127–159.

Vermeir, Koen. "Magical science of scientific magic? Rationality & irrationality, and the magic & science debate from a historical and philosophical perspective, PhD University of Leuven (Belgium), May 2005." *EASST Review: European Association for the Study of Science and Technology* 24 (2/3 2005): 15–17.

Vermeir, Koen. "Magical science or scientific magic?" *Education Forum / The British Society for the History of Science* 46 (2005): 3–5.

Vidal, Fernando *see also: Daston and Vidal*

Vidal, Fernando *see also: Gantet and Vidal*

Vidal, Fernando. "Nymphomania and the gendering of the imagination in the eighteenth century." In *Sexualität und Imagination: Pathologien der Einbildungskraft im medizinischen Diskurs der frühen Neuzeit*, eds. Stefanie Zaun, Daniela Watzke, and Jörn Steigerwald. 165–192. Frankfurt am Main: Klostermann, 2004.

Vidal, Fernando. "Psychologie empirique et méthodologie des sciences au siècle des Lumières. L'exemple de Jean Trembley." *Archives des Sciences* 57 (1 2004): 17–39.

Vidal, Fernando. "Le sujet cérébral: une esquisse historique et conceptuelle." *Psychiatrie, Sciences Humaines, Neurosciences* 3 (11 2005): 37–48.

Vöhringer, Margarete. "Im Proletformat: Medien für Transformationen und Transfusionen im Russland der 1920er Jahre." In *Transfusionen: Blutbilder und Biopolitik in der Neuzeit*, ed. Anja Lauper. 199–210. Zürich [u. a.]: Diaphanes Verlag, 2005.

Vöhringer, Margarete and Michael Hagner. "Vsevolod Pudovkins Mechanik des Gehirns – Film als psychophysiologisches Experiment." In *Bildtechniken des Ausnahmezustandes*, eds. Horst Bredekamp and Gabriele Werner. 82–92. Berlin: Akademie-Verlag, 2004.

Vogt, Annette *see also: Denz and Vogt*

Vogt, Annette *see also: Henning, Kant and Vogt*

Vogt, Annette *see also: Kant and Vogt*

Vogt, Annette *see also: Mohr and Vogt*

Vogt, Annette. "[Entries] 'Franklin', 'Freundlich', 'Geiringer', 'Gumbel', 'Hertz', 'Hodgkin (Crowfoot)', 'Kolmogorow', 'Kornfeld', 'Koroljow', 'Linden', 'Ljapunow', 'Markow'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 2: F bis Mei*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Vogt, Annette. "[Entries] 'Rabinowitsch-Kempner', 'Riemann', 'Schur', 'Sponer', 'Steiner', 'Stern, L.', 'Tschebyschew', 'Woker', 'Wrangell', 'Ziolkowski'." In *Lexikon der bedeutenden Naturwissenschaftler in drei Bänden. Bd. 3: Men bis Z*, eds. Dieter Hoffmann, Hubert Laitko, and Staffan Müller-Wille. Heidelberg [u. a.]: Spektrum Akademischer Verlag, 2004.

Vogt, Annette. "Von Berlin nach Rom – Anneliese Maier (1905–1971)." In '*... immer im Forschen bleiben': Rüdiger vom Bruch zum 60. Geburtstag*, eds. Marc Schalenberg and Peter T. Walther. 391–414. Stuttgart: Steiner, 2004.

Vogt, Annette. "Women scholars at German Universities—or why did this story start so late?" In *Women scholars and institutions: proceedings of the international conference, Prague, June 8–11, 2003. Vol. 1*, eds. Sona Strbánová, Ida H. Stamhuis, and Katerina Mojsejová. 159–186. Prague: Research Center for History of Sciences and Humanities, 2004.

Vogt, Annette. "Die Gastabteilungen in der Kaiser-Wilhelm-Gesellschaft – Beispiele internationaler Zusammenarbeit." In *Aus Wissenschaftsgeschichte und -theorie. Hubert Laitko zum 70. Geburtstag überreicht von Freunden, Kollegen und Schülern*, eds. Horst Kant and Annette Vogt. 321–343. Berlin: Verlag für Wissenschafts- und Regionalgeschichte Engel, 2005.

Vogt, Annette. "Le rôle des femmes scientifiques dans les universités et les institutions académiques en Allemagne de 1919 à 1945. Etude comparative." In *Les femmes dans les sciences de l'homme (XIXe–XXe siècles): inspiratrices, collaboratrices ou créatrices ?*, ed. Jacqueline Carroy. 124–150. Paris: Seli Arslan, 2005.

Vogt, Annette. "Von Fleiß und Sachverstand. Studentinnen und Akademikerinnen an der Mathematisch-Naturwissenschaftlichen Fakultät." In *Die Berliner Universität in der NS-Zeit. Bd. 1: Strukturen und Personen*, eds. Christoph Jahr and Rebecca Schaarschmidt. 179–191. München: Steiner, 2005.

Voss, Julia. "Das Auge der Evolution: Charles Darwin zeichnet den Zufall." *Lebendige Zeit: Wissenskulturen im Werden* (2005): 40–78.

Voss, Julia. "Zoologische Gärten, Tiermaler und die Wissenschaft vom Tier im 19. Jahrhundert." In *Stätten biologischer Forschung / P 03*, eds. Christiane Groeben, Joachim Kaasch, and Michael Kaasch. 227–243. Berlin: VWB – Verlag für Wissenschaft und Bildung, 2005.

Wahsner, Renate *see also: Borzeszkowski and Wahsner*

Wahsner, Renate. "'Der Natur ist die Äußerlichkeit eigentümlich ...'. Zur epistemologischen Position der Naturphilosophie Hegels." In *Hegels enzyklopädisches System der Philosophie. Von der 'Wissenschaft der Logik' zur Philosophie des absoluten Geistes*, eds. Hans-Christian Lucas, Burkhard Tuschling, and Ulrich Vogel. 169–196. Stuttgart-Bad Cannstatt: frommann-holzboog, 2004.

Wahsner, Renate. "'An seinen Werkzeugen besitzt der Mensch die Macht über die äußere Natur …'. Hegels Rezeption des techne-Begriffs in seiner Logik." In *Jahrbuch für Hegelforschung 2002/2003*, ed. Helmut Schneider. 174–195. Sankt Augustin: Academia Verlag, 2004.

Wahsner, Renate. "Von der metaphysikfreien Wissenschaft zur metaphysikfreien Philosophie?" In *Unser Zeitalter – ein postmetaphysisches?*, ed. Karen Gloy. 155–173. Würzburg: Königshausen & Neumann, 2004.

Wahsner, Renate. "Wer war der Mann? Albert Einstein. Nachträgliches zu seinem 125. Geburtstag." *Junge Welt*, 17.3.2004, 10–11.

Wahsner, Renate. "Absolute space: Mach vs. Newton." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 44–47. Weinheim: Wiley-VCH, 2005.

Wahsner, Renate. "Der absolute Raum: Mach vs. Newton." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 44–47. Weinheim: Wiley-VCH, 2005.

Wahsner, Renate. "' … der Sozialismus, seitdem er eine Wissenschaft geworden …' Gibt es überhaupt Umbrüche in einer Wissenschaft?" In *Philosophie und Politik: Festschrift für Robert Steigerwald*, eds. Willi Gerns, Hans Heinz Holz, Hermann Kopp, Thomas Metscher, and Werner Seppmann. 20–33. Essen: Neue Impulse Verlag, 2005.

Wahsner, Renate. "Die Relativität des Raumes und der Zeit. Stürzte Einstein das Newtonsche Weltbild?" *Revista de filosofía / Consejo Superior de Investigaciones Científicas, Instituto "Luis Vives" de Filosofía* 30 (1 2005): 25–45.

1

Wahsner, Renate. "Formelle und konkrete Einheit. Hegels Begriff des physikalischen Gesetzes." In *Die Natur in den Begriff übersetzen. Zu Hegels Kritik des naturwissenschaftlichen Allgemeinen*, eds. Thomas Posch and Gilles Marmasse. 17–37. Frankfurt a. M. [u. a.]: Lang, 2005.

1 Wahsner, Renate, ed. *Hegel und das mechanistische Weltbild. Vom Wissenschaftsprinzip 'Mechanismus' zum 'Organismus' als Vernunftbegriff*. Hegeliana; 19. Frankfurt a. M. [u. a.]: Lang, 2005.

Wahsner, Renate. "Lo spazio assoluto: Mach contro Newton." In *Albert Einstein: ingegnere dell'universo*, eds. Fabio Bevilacqua and Jürgen Renn. 254–257. Milano: Skira, 2005.

Wahsner, Renate. "Zum Verhältnis von Natur- und Gesellschaftsdialektik oder Das dialektische Auge als intellectus archetypus? (I)" *Marxistische Blätter* 43 (2 2005): 93–98.

Wahsner, Renate. "Zum Verhältnis von Natur- und Gesellschaftsdialektik oder Das dialektische Auge als intellectus archetypus? (II)" *Marxistische Blätter* 43 (3 2005): 90–96.

Wahsner, Renate. "Zur Bedeutung der Newtonschen Mechanik für Kants epistemologische Wende und seinen Begriff des Mechanismus." In *Hegel und das mechanistische Weltbild. Vom Wissenschaftsprinzip Mechanismus zum Organismus als Vernunftbegriff*, ed. Renate Wahsner. 43–53. Frankfurt am Main [u. a.]: Lang, 2005.

Wahsner, Renate and Horst-Heino v. Borzeszkowski. "Gibt es eine Logik der Physik als Vorstufe zur Hegelschen Begriffslogik?" In *Logik, Mathematik und Natur. Festschrift für Dieter Wandschneider zum 65. Geburtstag*, eds. Wolfgang Neuser and Vittorio Hösle. 51–77. Würzburg: Königshausen & Neumann, 2004.

Warwick, Andrew. "X-rays as evidence in German orthopaedic surgery 1895–1900." *Isis* 96 (1 2005): 1–24.

Wazeck, Milena *see also: Schüring and Wazeck*

Wazeck, Milena. "Die verfilmte Realität." *Spektrum der Wissenschaft Spezial: Einstein und die Folgen* (1 2005): 24–27.

Wazeck, Milena. "'Einstein auf der Mordliste!' Die Angriffe auf Einstein und die Relativitätstheorie 1922." In *Albert Einstein – Ingenieur des Universums: Hundert Autoren für Einstein*, ed. Jürgen Renn. 222–225. Weinheim: Wiley-VCH, 2005.

Wazeck, Milena. "Einstein in the daily press: a glimpse into the Gehrcke papers." In *The universe of general relativity*, eds. Anne J. Kox and Jean Eisenstaedt. 339–356. Boston [u. a.]: Birkhäuser, 2005.

Wazeck, Milena. "'Einstein on the murder list!': The attacks on Einstein and the theory of relativity in 1922." In *Albert Einstein—chief engineer of the universe: one hundred authors for Einstein*, ed. Jürgen Renn. 222-225. Weinheim: Wiley-VCH, 2005.

Wazeck, Milena. "Physik in bräunlichem Sumpf." *Frankfurter Allgemeine Sonntagszeitung*, 20.11. 2005, 77.

Wazeck, Milena. "Schwierige Reise. Frankreich-Besuch von nationalistischen Ressentiments überschattet." *Portal: die Potsdamer Universitätszeitung* (1/3 2005): 28-29.

Wazeck, Milena. "Wer waren Einsteins Gegner?" *Aus Politik und Zeitgeschichte: APuZ* (25–26 2005): 17–23.

Wiesenfeldt, Gerhard *see also: Ceranski, Hars and Wiesenfeldt*

Wiesenfeldt, Gerhard. "Jan Keysers van Breda, Notaris in Batavia. Oder: Von den Schwierigkeiten, ein Gelehrter zu werden." In *Auf den Schultern von Zwergen: Essays an den Grenzen von Physik und Biografie*, eds. Beate Ceranski, Florian Hars, and Gerhard Wiesenfeldt. 19–36. Berlin [u. a.]: ERS-Verlag, 2005.

Williams, Lambert. "Cardano and the gambler's habitus." *Studies in History and Philosophy of Science* 36A (1 2005): 23–41.

Wise, M. Norton. "William Thomson and Peter Guthrie Tait, 'Treatise on natural philosophy, first edition (1867)'." In *Landmark writings in western mathematics, 1640–1940*, ed. Ivor Grattan-Guinness. 521-533. Amsterdam: Elsevier, 2005.

Wise, M. Norton and Elaine M. Wise. "Staging an empire." In *Things that talk: object lessons from art and science*, ed. Lorraine Daston. 101–145. New York: Zone Books, 2004.

Wittmann, Barbara *see also: Endres, Wittmann et al.*

1 2 3

Wittmann, Barbara. "Critica d`arte scarabocchiata, verso il 1500 / Art criticism scribbled, around 1500." In *Les enfants terribles. Il linguaggio dell'infanzia nell'arte, 1909–2004 / The language of childhood in art, 1909–2004*, ed. Museo cantonale d`arte di Lugano. 28–41. Lugano: Silvana Editoriale, 2004.

Wittmann, Barbara. "Edouard Manet, 'Porträt Emile Zola'." *Kunsthistorische Arbeitsblätter* 12 (2004): 29–36.

1 Wittmann, Barbara. Gesichter geben: *Édouard Manet und die Poetik des Portraits*. München: Fink, 2004.

Wittmann, Barbara. "Le temps retrouvé: Claude Monets 'Getreideschober' zwischen 'impression' und Nachträglichkeit." In *Momente im Prozess: Zeitlichkeit künstlerischer Produktion*, eds. Karin Gludovatz and Martin Peschken. 211–226. Berlin: Reimer, 2004.

Wittmann, Barbara. "Gustave Courbet: Die Begegnung (Bonjour Monsieur Courbet!), 1854." In *Der Künstler als Kunstwerk. Selbstporträts vom Mittelalter bis zur Gegenwart*, eds. Ulrich Pfisterer and Valeska von Rosen. 124–125. Stuttgart: Reclam, 2005.

Wittmann, Barbara. "Pablo Picasso: Selbstbildnis mit Palette, 1906." In *Der Künstler als Kunstwerk. Selbstporträts vom Mittelalter bis zur Gegenwart*, eds. Ulrich Pfisterer and Valeska von Rosen. 146–147. Stuttgart: Reclam, 2005.

Wittmann, Barbara. "Sofonisba Anguissola: Bernardino Campi malt Sofonisba Anguissola, um 1559." In *Der Künstler als Kunstwerk. Selbstporträts vom Mittelalter bis zur Gegenwart*, eds. Ulrich Pfisterer and Valeska von Rosen. 64–65. Stuttgart: Reclam, 2005.

Wittmann, Barbara. "Textile Schwellenräume: Einführung." In *Ikonologie des Zwischenraums: der Schleier als Medium und Metapher*, eds. Johannes Endres, Barbara Wittmann, and Gerhard Wolf. 185–191. Paderborn [u. a.]: Fink, 2005.

Wittmann, Barbara. "Vom Tuch der Gespenster: Einführung." In *Ikonologie des Zwischenraums: Der Schleier als Medium und Metapher*, eds. Johannes Endres, Barbara Wittmann, and Gerhard Wolf. 301–308. Paderborn [u. a.]: Fink, 2005.

2 Wunderlich, Falk. *Kant und die Bewußtseinstheorien des 18. Jahrhunderts*. Quellen und Studien zur Philosophie; 64, Berlin [u. a.]: de Gruyter, 2005.

Zemplén, Gábor A. *see also: Fazekas and Zemplén*

Zemplén, Gábor A. *see also: Gervain and Zemplén*

3 Zemplén, Gábor Á. *The history of vision, colour, & light theories: introductions, texts, problems*. Bern studies in the history and philosophy of science: educational materials; 5, Bern: Bern studies in the history and philosophy of science, 2005.

Ziegler, Rafael. "Accountability, calculated reality and sustainable development." In *Environmental accounting—sustainable development indicators: proceedings of the International Conference 25–27 September 2005, Prague*, ed. Iva Ritschelová. 208–219. Usti nad Labem: Jan Evangelista Purkyne Univ., 2005.

Preprints 2004–2005

No. 253 *Bernhard Dotzler, Henning Schmidgen und Cornelia Weber* (Hrsg.) Parasiten und Sirenen: Zwei ZwischenRäume
No. 254 *Alfred Gierer* Human Brain Evolution, Theories of Innovation, and Lessons from the History of Technology
No. 255 *Aimé Sègla* et *Adékin Boko* De la Cosmologie à la Rationalisation de la vie sociale: Ces mots Idaacha qui parlent ou la mémoire d'un type de calendrier Yoruba ancien [1]
No. 256 *Aimé Sègla* De la Cosmologie à une Théorie du Nombre: Le corpus Ifa revisité comme un questionnement de la mathématique orale
No. 257 *Aimé Sègla* Instruments et Objets de l'Evolution du Développement du Concept de Nombre en Yoruba: Relecture Epistémologique
No. 258 *Sergio Nobre* Christian Wolffs Beitrag zur Popularisierung der Mathematik in Deutschland, europäischen und außereuropäischen Ländern
No. 259 *M. J. Geller* Akkadian Healing Therapies in the Babylonian Talmud
No. 260 *Ursula Klein* Atomism in the first half of the XIXth century
No. 261 *Giuseppe Castagnetti* and *Hubert Goenner* Einstein and the Kaiser Wilhelm Institute for Physics (1917–1922): Institutional Aims and Scientific Results
No. 262 *Albert Presas i Puig* Numbers, Proportions, Harmonies, and Practical Geometry in Ancient Art
No. 263 *Albert Presas i Puig* Science and Technology on the Periphery. The Spanish Reception of Nuclear Energy and the German Advice
No. 264 *Michel Janssen* and *Jürgen Renn* Untying the Knot: How Einstein Found His Way Back to Field Equations Discarded in the Zurich Notebook
No. 265 *Michel Janssen* and *John Stachel* The Optics and Electrodynamics of Moving Bodies
No. 266 *Marie-Noëlle Bourguet* Écriture du voyage et construction savante du monde. Le carnet d'Italie d Alexander von Humboldt
No. 267 *Horst-Heino v. Borzeszkowski*, *Hans-Jürgen Treder* and *Renate Wahsner* Aspects of the History of Gravitational Theories
No. 268 *Mechthild Fend* Bodily and Pictorial Surfaces. The Representation of Skin in late 18th and 19th Century France
No. 269 *Sonja Brentjes* Peiresc's interests in the Middle East and Northern Africa in respect to geography and cartography
No. 270 *Renate Wahsner* Der Widerstreit von Mechanismus und Organismus. Ein Widerstreit zweier Denkprinzipien der neuzeitlichen Naturwissenschaft?
No. 271 *Jürgen Renn*, *Matthias Schemmel*, and *Milena Wazeck* In the Shadow of the Relativity Revolution
No. 272 *Bernhard Kleeberg*, *Wolfgang Lefèvre*, *Julia Voss* Zum Darwinismusstreit
No. 273 *Ursula Klein* Experiments at the Intersection of Experimental History, Technological Inquiry, and Conceptually Driven Analysis A Case Study from Early Nineteenth-Century France
No. 274 *Tibor Frank* George Pólya and the Heuristic Tradition
No. 275 *Tibor Frank* Ever Ready to Go: The Multiple Exiles of Leo Szilard [Part I–III]

No. 276 *Staffan Müller-Wille* and *Hans-Jörg Rheinberger* Heredity—The Production of an Epistemic Space
No. 277 *Michel Janssen* and *Matthew Mecklenburg* Electromagnetic Models of the Electron and the Transition from Classical to Relativistic Mechanics
No. 278 *Caroline Welsh* und *Christoph Hoffmann* [Hrsg.] "in jedem Augenblick auf das Äußerste gefaßt". Aus dem Labor philologischer Neugierde
No. 279 *Bettina Gockel* und *Michael Hagner* [Hrsg.] Die Wissenschaft vom Künstler. Körper, Geist und Lebensgeschichte des Künstlers als Objekte der Wissenschaften, 1880–1930
No. 280 *Philipp Felsch* Müde Augen. Physiologische Alpenreisen im fin de siècle
No. 281 *Sachiko Kusukawa* From Counterfeit to Canon: Picturing the human body, especially by Andreas Vesalius
No. 282 *Don Handelman* Night
No. 283 *John Stachel* Fresnel's (Dragging) Coefficient as a Challenge to 19th Century Optics of Moving Bodies
No. 284 *Sicco Lehmann-Brauns* Kritische Gelehrsamkeit und mystische Gelehrsamkeitskritik – C. A. Heumann und G. Arnold im Spannungsfeld von 'Knowledge and Belief'
No. 285 *Alfred Gierer* Willensfreiheit aus neurowissenschaftlicher und theologiegeschichtlicher Perspektive – Ein erkenntniskritischer Vergleich
No. 286 *Dieter B. Herrmann* Über Albert Einsteins politische Ansichten. Ein Briefwechsel zwischen Dieter B. Herrmann und Ernst G. Straus aus den Jahren 1960–1962
No. 287 *Joseph Ziegler* On the Use of the "New Sciences" (Medicine, Alchemy, Astrology, and Physiognomy) for Religious Purposes c. 1300
No. 288 *Cornelius Borck*, *Volker Hess* und *Henning Schmidgen* Erkenntnis des Lebenden. Eine Skizze zu Georges Canguilhem (1904–1995)
No. 289 *István M. Bodnár* Aristotle's rewinding spheres: Three options and their difficulties
No. 290 *Scott Mandelbrote* 'Converse with Books': Scientific and Medical Libraries in the British Isles, c. 1640 – c. 1750
No. 291 *Barbara Wittmann* Zeichnen, im Dunkeln. Psychophysiologie einer Kulturtechnik um 1900
No. 292 *Massimiliano Badino* The Foundational Role of Ergodic Theory
No. 293 *Elke Flatau* Albert Einstein als wissenschaftlicher Autor
No. 294 *Conference* A Cultural History of Heredity III: 19th and Early 20th Centuries
No. 295 *Erna Fiorentini* Instrument des Urteils. Zeichnen mit der Camera Lucida als Komposit
No. 296 *Arne Schirrmacher* Dreier Männer Arbeit in der frühen Bundesrepublik. Max Born, Werner Heisenberg und Pascual Jordan als politische Grenzgänger
No. 297 *Rhodri Lewis* Of Origenian Platonisme: Joseph Glanvill on the Pre-Existence of Souls
No. 298 *Albert Presas i Puig* Continuities in Radical Changes: The Technological Relationships between Germany and Spain in the 20th Century

No. 299 *Albert Presas i Puig* "Germania docet": On a lecture trip to Spain. The scientific relations between Germany and Spain during the Entente boycott (1919–1926)
No. 300 *Albert Presas i Puig* Spain in 1952 as seen by a German warship builder: Modernisation programmes of the submarine fleet under Franco's first regime and German specialists
No. 301 *Günter Dörfel* und *Dieter Hoffmann* Von Albert Einstein bis Norbert Wiener – frühe Ansichten und späte Einsichten zum Phänomen des elektronischen Rauschens
No. 302 *Angelo Baracca* (ed.) History of the Development of Physics in Cuba. The development of an advanced scientific system in an underdeveloped country
No. 303 *Christian Forstner* Dialectical Materialism and the Construction of a New Quantum Theory: David Joseph Bohm, 1917–1992
No. 304 *Erna Fiorentini* (ed.) The Osmotic Dynamics of Romanticism Observing Nature—Representing Experience 1800–1850

Index

doppelpunkt, berlin

MAX-PLANCK-INSTITUT FÜR WISSENSCHAFTSGESCHICHTE

Boltzmannstraße 22, 14195 Berlin, Telefon (+4930) 22667–0, www.mpiwg-berlin.mpg.de